National Round Table on the Environment and the Economy | Table ronde nationale sur l'environnement et l'économie

Response of the National Round Table on the Environment and the Economy to its Obligations Under the *Kyoto Protocol Implementation Act*

July 2008

Transmittal Letter from the Chair

July 2008

Dear Minister:

The National Round Table on the Environment and the Economy (NRTEE) is pleased to submit to you its second response to its obligations under the *Kyoto Protocol Implementation Act* (KPIA) with respect to the government's Climate Change Plan and Statement.

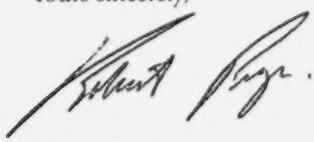
In carrying out its statutory obligations, the NRTEE had undertaken research, gathered information, and produced a written response as required. This activity focused on addressing Subsections 10(1)(b)(i) and 10(1)(b)(ii) of the Act. As allowed for under Subsection 10(1)(b)(iii), the Round Table has also reviewed and commented upon broader aspects of the Act as it relates to the government's Plan and Statement.

With this document, the NRTEE has fulfilled the filing requirements of Section 10 of the *Kyoto Protocol Implementation Act*. We wish to thank officials of Environment Canada, Natural Resources Canada, and Transport Canada for their cooperation in providing information that we used in the preparation of this response.

Moving forward, the NRTEE has taken the initiative to pursue additional research to respond to key forecasting issues highlighted in its 2007 KPIA Response. The Round Table felt it would be useful to examine how other countries approach similar challenges to those faced by the federal government in emissions forecasting. The results can be found in our report entitled *Greenhouse Gas Emissions Forecasting – Learning From International Best Practices* submitted along with the NRTEE's 2008 KPIA Response.

We hope these documents will be useful to you and your department in approaching and evaluating expected emissions reductions from federal climate change policies and measures in the future.

Yours sincerely,



Robert Page
Chair

Table of Contents

National Round Table on the Environment and the Economy: Mandate i

Members of the National Round Table on the Environment and the Economy ii

Response of the National Round Table on the Environment and the Economy to its Obligations Under the *Kyoto Protocol Implementation Act* 1

Appendices:

A: Analysis and Assessment of Individual Measures with Greater than 1 Tonne of Emissions Reductions in Any Given Year 13

B: Description of Additionality, Free Ridership, Rebound Effect, and Policy Interaction Effects 30

C: Detailed Description and Comparison of the Baseline Emissions Pathway and the KPIA Emissions Pathway 31

D: *Kyoto Protocol Implementation Act* (C-288) 35

References 45

National Round Table on the Environment and the Economy | Table ronde nationale sur l'environnement et l'économie

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National Round Table on the Environment and the Economy

About Us

The National Round Table on the Environment and the Economy (NRTEE) is dedicated to exploring new opportunities to integrate environmental conservation and economic development, in order to sustain Canada's prosperity and secure its future.

Drawing on the wealth of insight and experience represented by our diverse membership, our mission is to generate and promote innovative ways to advance Canada's environmental and economic interests in combination, rather than in isolation. In this capacity, it examines the environmental and economic implications of priority issues and offers advice on how best to reconcile the sometimes competing interests of economic prosperity and environmental conservation.

The NRTEE was created by the government in October 1988. Its independent role and mandate were enshrined in the *National Round Table on the Environment and the Economy Act*, which was passed by the House of Commons in May 1993. Appointed by Governor in Council, our members are distinguished leaders in business and labour, universities, environmental organizations, Aboriginal communities and municipalities.

How We Work

The NRTEE is structured as a round table in order to facilitate the unfettered exchange of ideas. By offering our members a safe haven for discussion, the NRTEE helps reconcile positions that have traditionally been at odds.

The NRTEE is also a coalition builder, reaching out to organizations that share our vision for sustainable development. We believe that affiliation with like-minded partners will spark creativity and generate the momentum needed for success.

And finally, the NRTEE acts as an advocate for positive change, raising awareness among Canadians and their governments about the challenges of sustainable development and promoting viable solutions.

We also maintain a secretariat, which commissions and analyses the research required by our members in their work. The secretariat furnishes administrative, promotional and communications support to the NRTEE.

Our Current Projects

The members of the NRTEE meet four times a year to review their research and conduct their deliberations. Our current projects focus on:

- Energy Efficiency in the Commercial Buildings Sector
- Climate Change Adaptation Policy for Northern Infrastructure
- Carbon Emissions Pricing Policies

For more details on past and current programs, visit our website at **http://www.nrtee-trnee.ca**.

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Response of the National Round Table on the Environment and the Economy to its Obligations Under the *Kyoto Protocol Implementation Act*

July 2008

1. Background

On June 22, 2007, the *Kyoto Protocol Implementation Act* (henceforth the KPIA, or C-288), received Royal Assent.

The KPIA stipulates that the Government of Canada is obliged to prepare—on an annual basis—a Climate Change Plan describing measures and policies enacted by the government to "ensure that Canada meets its obligations under Article 3, paragraph 1, of the Kyoto Protocol" [Subsection 5(1)]. The first annual plan is to be prepared within 60 days of the KPIA coming into force. The KPIA further provides that "Within 120 days after this Act comes into force, the Minister of the Environment shall prepare a statement setting out the greenhouse gas emission reductions that are reasonably expected to result for each year up to and including 2012 …" as a result of the Climate Change Plan. The provision of a statement is required only for the first year the government publishes its plan.

The government's first Climate Change Plan and Statement were released simultaneously on August 21, 2007, and entitled *A Climate Change Plan for the Purposes of the Kyoto Protocol Implementation Act 2007*. The NRTEE submitted its response to the Minister of the Environment, entitled *Response of the National Round Table on the Environment and the Economy to its Obligations under the Kyoto Protocol Implementation Act*, on September 20, 2007. The government's second Climate Change Plan was released on May 31, 2008.

Subsection 10(1) of the Act requires the National Round Table on the Environment and the Economy (NRTEE or Round Table) to, within 60 days of the publication of the Climate Change Plan stipulated in Subsection 5(1), perform the following with respect to the Plan:

a. undertake research and gather information and analyses on the Plan or Statement in the context of sustainable development; and

b. advise the Minister on issues that are within its purpose, as set out in section 4 of the National Round Table on the Environment and the Economy Act, including the following, to the extent that they are within that purpose:

   i. the likelihood that each of the proposed measures or regulations will achieve the emission reductions projected in the Plan or Statement;

   ii. the likelihood that the proposed measures or regulations will enable Canada to meet its obligations under Article 3, paragraph 1, of the Kyoto Protocol, and

   iii. any other matters that the Round Table considers relevant.

This report represents the second response of the National Round Table on the Environment and the Economy to the requirements created by the *Kyoto Protocol Implementation Act*, and is in direct response to the government's second Climate Change Plan. In carrying out its statutory obligations, the NRTEE has undertaken and gathered information. This activity has focused on addressing Subsections 10(1)(b)(i) and 10(1)(b)(ii). As allowed for under Subsection 10(1)(b)(iii), the NRTEE has also reviewed and commented upon broader aspects of the KPIA as it relates to the government's Plan.

In accordance with the stipulations of the Act, the report has been provided to the Minister of the Environment. This fulfils the NRTEE's current obligations under the KPIA.

2. Introduction

In *A Climate Change Plan for the Purposes of the Kyoto Protocol Implementation Act*, (henceforth referred to as the 2008 Plan), the government details expected emissions reductions resulting from specific actions to address climate change.

It includes a comprehensive modelling analysis that presents the reductions expected to accrue from the suite of policies relative to a Baseline Emissions Pathway. The stated emissions reductions for individual policies outlined in the 2008 Plan are derived from initiative-level evaluations performed by Environment Canada, Natural Resources Canada (NRCan), and Transport Canada, while the aggregate figures are compiled by Environment Canada.

The analysis below examines whether the stated emissions reductions attributed to the suite of policies as a whole and to individual policies are likely to achieve the projected incremental emissions reductions we should expect to see as a result of their implementation.[1] By extension, the report also assesses the degree to which the emissions projections reflect reasonable expectations of what will be seen in greenhouse gas (GHG) emissions inventories for the years 2008–2012.

The report proceeds as follows. First, it begins with a description of the methodological approach to the evaluation employed by the NRTEE. Next, an overview of key changes in the 2008 Plan from the 2007 Plan is provided. After that, an examination of the emissions reductions proposed by the 2008 Plan's integrated analysis is presented. Included here is an assessment of how this relates to individual policy measures as well as the overall effect of achieving the Kyoto Protocol targets for Canada. The main report finishes with conclusions and recommendations.

3. Methodology

In its 2007 Response to its obligations under the KPIA, the NRTEE developed an analytical framework by which to evaluate the likelihood that the proposed measures or regulations would achieve the projected emission reductions in the Plan, and the likelihood that the proposed measures would allow Canada to meet its requirements under the Kyoto Protocol. The NRTEE has used the same methodological approach in its 2008 Response.

An initial assessment of the necessary (and available) analytical tools and methodologies led the NRTEE to conclude that the best approach to assessing *likelihood* was to determine whether the estimates themselves were accurate descriptions of the outcomes that could reasonably be expected from the policies and program initiatives described in the government's Plan. Given the nature of the mandate and the timelines involved, the presentation of a qualitative sense of predictive accuracy as opposed to a complete modelling of policy outcomes was chosen as the most appropriate. As a result, the NRTEE has derived, where possible, a qualitative conclusion for each policy or measure. The statistical evidence and underlying assumptions suggest one of the following:

- An overestimate of eventual emissions reductions
- A reliable estimate of eventual emissions reductions
- An underestimate of eventual emissions reductions

To be clear, the NRTEE is not in a position to provide a definitive statement on the emissions reduction level attributable to each policy and measure individually, or in total. Rather, it is providing an assessment—on the basis of what it

1 Incremental emissions reductions are those that occur over and above what could reasonably have been expected to occur without the policies or actions.

knows about the underlying assumptions—of whether the measures and policies described in the Plan are likely to result in the suggested emissions reduction levels. All forecasting is, by definition, speculative and cannot be expected to be 100 per cent accurate. Defining the likelihood of achieving a stated emission reduction must in turn be qualified by this assumption.

4. Key Changes in the 2008 Government KPIA Plan from the 2007 Plan

The NRTEE's starting point in its analysis was to understand any changes between the 2008 Plan and the 2007 Plan. Three main ones appeared.

1. Integrated Modelling Approach

This year's Plan incorporates a new, integrated modelling approach that compares forecast emission reductions altogether, and not just individually and added incrementally. This is a significant improvement over last year's Plan and follows a recommendation for methodological improvement made by the NRTEE in its 2007 Response. Integrated modelling is more accurate because it should correct for the *policy-interaction* effects and in many cases for the *rebound* and *free-rider* effects that leads to double-counting of emission reductions, or *additionality*.[2] This occurs when the estimated emissions reductions from policy measures are added up individually. The sum of the individual program is a different, higher number of projected emission reductions than if the policies were modelled together (as is now being done), as the interaction of various policy measures can lessen the reductions attributed to individual measures. However, the rebound and free-rider effects can still occur within an integrated modelling approach depending on the modelling assumptions, particularly with respect to how the technology fund and domestic offset purchases are accounted for in the 2008 Plan. The NRTEE analysis has therefore examined the forecast emission reductions both on an integrated and an individual policy basis.

2. New Baseline

A significant change in the interpretation of the projected reductions in the 2008 Plan results from the introduction of a new reference scenario, termed the *Baseline Emissions Pathway*, which reflects the latest GHG inventory. Environment Canada developed this new scenario using its Energy-Economy-Environment Model for Canada, or E3MC. This scenario includes the impacts of all government actions announced up to January 1, 2006, which is the same cut-off date used for the reference case in Environment Canada's March 2008 document entitled *Detailed Emissions and Economic Modelling*. However, the Baseline Emissions Pathway set out in the 2008 Plan has a much lower emissions profile than that introduced by Environment Canada in March 2008. This is due to an adjustment made to account for updated emissions inventory data released by Statistics Canada. The NRTEE analysis has had to account for this difference in reference scenarios.

3. New Kyoto Protocol Requirements

Updated emissions inventory numbers published by Statistics Canada have led to a change in the Kyoto compliance level for Canada. The new figures place Canada's 1990 emissions at 594 Mt, updated from previous figures of 598 Mt. Canada's Kyoto commitment is based on a 6% reduction in emissions relative to 1990 levels. This means that emissions over the 2008 to

2 In its 2007 KPIA Response, the NRTEE identified four accounting issues that led the Round Table to conclude the government had overestimated the likely emissions reductions as laid out in its Plan. Please refer to Appendix B for a discussion of additionality, free ridership, rebound effect, and policy interaction effects.

2012 period—net of reductions credited through the Kyoto Protocol flexibility mechanisms—must average 558 Mt, compared with the 2007 Plan that was based on a Kyoto target of 563 Mt. These updated figures imply that, in order to be in compliance with the Kyoto Protocol, lower emissions levels than previously estimated will be required. The NRTEE analysis has taken this into account.

5. Analysis and Assessment

The NRTEE's analysis and assessment of the 2008 Plan focused first on an evaluation of the integrated modelling results. The lack of integrated modelling was cited in the 2007 NRTEE Response as leading to an overestimate of likely emission reductions contained in the 2007 Plan. Our evaluation objective was to assess whether policy measures would lead to truly incremental or additional emission reductions; specifically, whether concerns about free ridership, additionality, and the rebound effect are taken into account when providing the estimate for the likely emission reduction for the policy measure, both individually and as part of a whole. Another objective of the analysis was to determine the extent to which policy interaction effects had been taken into account in the government's analysis; that is, had the entire suite of policies been evaluated together in order to assess their combined impact, or had the policies been evaluated only on an individual basis.

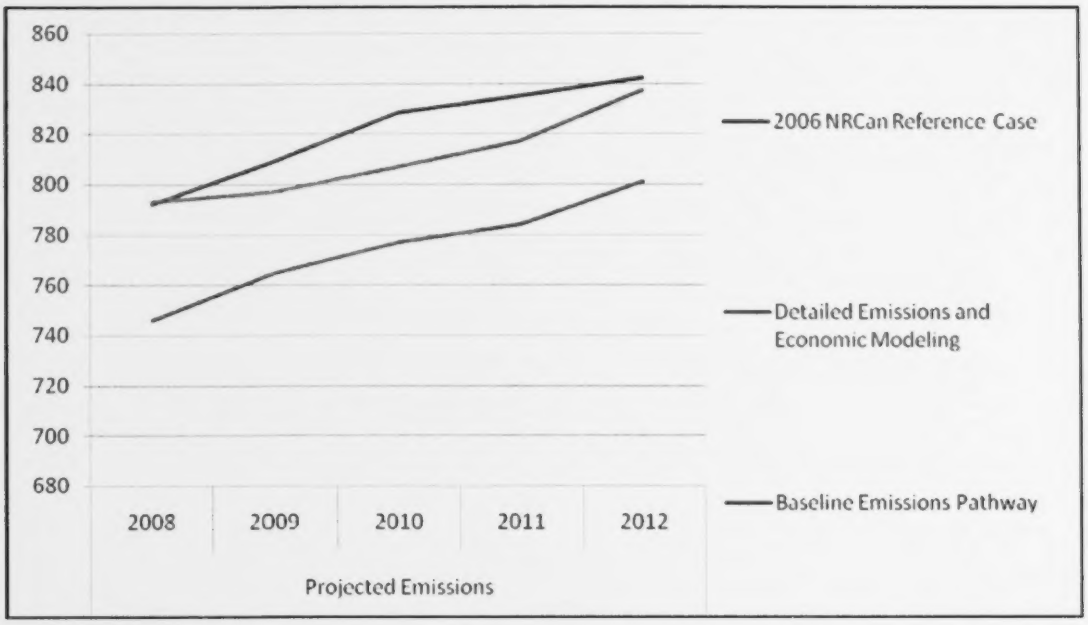
In the 2008 Plan, the comparison of integrated models executed with and without the policies imposed represents a significantly improved method of forecasting policy impacts. Two issues, however, remain. First, there is concern that the purchase of domestic offsets has not been fully accounted for and critically assessed within the model. This issue is discussed in section 5.1.3. Second, an issue remains with the presentation of individual policy measures and their consistency with the integrated modelling results, as we note in 5.2 below.

5.1 Forecasting Emissions Reductions

A forecast of emissions reductions is actually the result of two forecasts—forecasts of what quantity of emissions are likely to be released with *and* without the policy in place. The difference between these two forecasts is a measure of the effect of the policy, or the projected emissions reductions. The integrated modelling analysis contained in the 2008 Plan results in two new economy-wide forecasts: a Baseline Emissions Pathway and the KPIA Emissions Pathway. The Baseline Emissions Pathway represents a forecast of what is expected to occur without the intervention of any of the proposed policies or other initiatives. In previous government plans, this was called the reference case or business-as-usual (BAU) scenario. The KPIA Emissions Pathway is a forecast of what will occur with all of the policies in place for the period of the Kyoto Protocol. Policy impacts are tabulated as the difference between the two forecasts, termed the *expected emissions reductions* resulting from implementing the policies.[3]

3 Basing and evaluating climate policy on accurate emissions forecasts is vital. In support of this, the NRTEE has prepared a companion document entitled *Greenhouse Gas Emissions Forecasting – Learning from International Best Practices*. This document reviews how other countries approach emissions forecasting, both from methodological and governance perspectives. It offers lessons for Canada to further improve our GHG forecasting capabilities.

Figure 1: Reference Cases and the Baseline Pathway Emissions



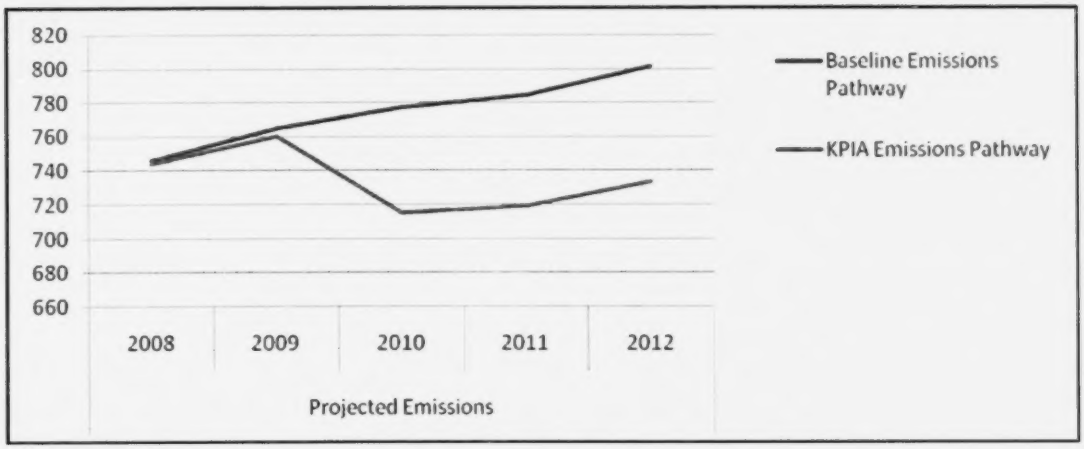
5.1.1 Baseline Emissions Pathway

As shown in Figure 1 above, the Baseline Emissions Pathway predicts emissions under no policy intervention. It is significantly lower than the Environment Canada reference case as presented in the March 2008 document entitled *Detailed Emissions and Economic Modelling*.[4]

It is important to understand why the starting point for the integrated modelling in the KPIA Plan—the Baseline Emissions Pathway—represents a much lower emissions trajectory than has previously been put forward for Canada. The change in the Baseline Emissions Pathway is due to an adjustment made to account for updated emissions inventory data provided to Environment Canada by Statistics Canada. While the March 2008 reference case published by Environment Canada had projected 2006 emissions at 760 Mt, new inventory data from Statistics Canada estimated 2006 emissions inventories at 721 Mt. Given this new information, Environment Canada adjusted its Baseline Emissions Pathway in the 2008 Plan to reflect 2006 emissions inventories—essentially through a downward shift in the reference case forecast. While the KPIA requires the government to use the most recent emissions inventory for Canada as the basis for its forecast in the Plan, shifting the entire forecast down by 40+ Mt on the basis of emissions inventory data for a single year seems unnecessary and inconsistent with previously established reference cases. The NRTEE provides a potential way to address this issue in the Conclusions and Recommendations section of this report.

4 To calculate the reference case, the emissions levels represented on the top line of the wedge diagram on page 7 of Turning the Corner (2007) and the Reference Path given on page 3 of *Detailed Emissions and Economic Modelling* were interpolated from the provided diagrams. In the first case, the top line in the wedge diagram is be taken to represent expected emissions with no provincial or territorial actions, without a clean electricity regulation, and with no federal actions.

Figure 2: Baseline and KPIA Emissions Pathways



5.1.2 KPIA Emissions Pathway

In contrast to the Baseline Emissions Pathway, the KPIA Emissions Pathway is to be interpreted as a forecast of what will occur when all the policies proposed in the 2008 Plan are put in place simultaneously. The effects of the policies were simulated using Environment Canada's E3MC, the same model as was used to calculate the Baseline Emissions Pathway under the same assumptions about growth trends and provincial actions, as illustrated in Figure 2 above.

5.1.3 Implications of the Pathways and the Technology Fund within the Integrated Modelling Analysis

The difference between the Baseline Emissions Pathway and the KPIA Emissions Pathway cannot be interpreted as actual emissions reductions.[5] In order to tabulate emissions reductions, it is preferable to compare a forecast of actual emissions *with and without* the policy, with the difference between the two being the actual reduction in emissions. In the 2008 Plan, the comparison made is between a Baseline Emissions Pathway and the KPIA Emissions Pathway, which includes emissions offset by contributions to the technology fund and by other domestic offsets. The first is a forecast of actual emissions, while the second measures a regulatory quantity, not actual emissions, and so the difference between the two is less informative. A footnote is included to this effect on page 24 of the 2008 Plan, which states that, "actual emissions reductions will depend on the compliance options chosen by firms." The Conclusions and Recommendations section of this report presents a possible approach to addressing this issue and including estimates that are more accurate as the Plan moves forward.

Contributions to the technology fund today will be used to finance future emissions reductions. There is no guarantee that the quantity of future emissions reductions will be equivalent to the volume of emissions offset today. In fact, in *Detailed Emissions and Economic Modelling* (2008), it is clear that emissions reductions are not realized from investments in the fund until 2016, outside the scope of the present Kyoto Protocol period. Even then they are only expected to "account for another 20 megatonnes" per year.

5 Please refer to Appendix B for a detailed evaluation and comparison of the Baseline Emissions Pathway and the KPIA Emissions Pathway.

While technology fund contributions make up a substantial part of compliance activities, the use of domestic offsets is also an important component. Domestic offset purchases account for 30 Mt of stated emissions reductions over the 2010–2012 period. Offsets effectively involve subcontracting emissions reductions to other firms who can meet established standards to demonstrate achieved emissions reductions. *Canada's Offset System for Greenhouse Gases* (2008) stipulates which criteria a project must meet in order to be certified as an offset. In order for offset purchases to represent actual emissions reductions, the abatement activities that generate the offset must be incremental to emissions reductions that would have occurred without the offset program. It is likely that the emissions reductions attributed to domestic offset purchases in the 2008 Plan are overestimated. In the KPIA period, it is probable that much of the industrial response to federal climate policy will happen in the form of offsets. Potential offsets in response to industrial regulation could be in landfill gas, no-till farming, afforestation, fugitive emissions, energy efficiency, and fuel switching. Yet the integrated modelling of domestic offsets in the 2008 Plan assumes that only landfill gas offsets will occur. This suggests that the modelling could miss the other offsets, leading to free-rider and rebound effects.

Other than the concern with a substantially lower baseline and the method of accounting for technology fund contributions and offsets (a detailed explanation of which is provided in Appendix A), the modelling represents an accurate and reliable overall estimate of the outcomes of the policies. As with any model, some assumptions may be less realistic than others, but these assumptions are clearly stated in the March 2008 *Detailed Emissions and Economic Modelling* document, which allows the estimates to be interpreted with the assumptions in mind, as we have done. This additional detail and transparency provided by the government in its Plan responds to a recommendation by the NRTEE in its 2007 Response.

5.2 Policy-by-Policy Emissions Reductions

The 2008 Plan provides estimates for emissions reductions expected to occur as a result of specific policies. The NRTEE's obligations under the KPIA include an evaluation of these policy-by-policy estimates. In support of the 2008 Plan, more documentation and detail on information programs was provided, enabling an analysis of these programs that we were not able to conduct last year. In Appendix A, programs with claimed reductions of greater than 1Mt in any given year are examined to illustrate some general trends and to highlight specific aspects of the analysis.

At issue in the policy-by-policy evaluation is that while the integrated modelling has been added to the 2008 Plan, the calculation of the policy-by-policy estimates, required under the Act, has been undertaken in the same way as in the 2007 Plan, although some individual estimates have changed. This leads to a discrepancy between the estimates for emission reductions for the policies as a whole based on the integrated modelling, and the estimates for the individual policy measures. Some of this discrepancy is expected due to policy interaction effects, but further information in the 2008 Plan of how to interpret the two sets of numbers explaining this would have been helpful.

Table A below shows the stated emissions reductions associated with specific policies and actions as stated in the 2008 Plan. As the table shows, when added together, the individual policies account for 4 Mt of reductions in 2008 (16 Mt attributed to the Clean Air and Climate Change Trust Fund were not included in this sum), while the modelling output on page 24 of the 2008 Plan predicts only 2 Mt of reductions. The bottom rows of the Table compare the

Table A: Reported GHG Emissions Reductions by Policy (Mt)

Measure	Year 2008	2009	2010	2011	2012
Policy-level emissions reductions included in the 2008 Plan					
Regulatory Framework for Industrial Greenhouse Gas Emissions	0	0	52	55	56
Energy Efficiency Regulations and Phasing out inefficient incandescent light bulbs	0.36	0.88	1.23	1.54	4.07
Regulating Renewable Fuels Content	0	0	0.8	0.8	1.9
ecoENERGY for Renewable Power	2.2	3.74	5.45	6.67	6.67
ecoENERGY for Buildings and Houses	0.32	0.56	1.13	1.57	2.02
ecoENERGY Retrofit Initiative	0.44	0.69	0.94	1	1
ecoMOBILITY Initiative	0	1.24	1.63	1.65	1.68
ecoFREIGHT Program	0	0.65	1.19	1.22	1.26
Programs reporting less than 1Mt in all years	0.58	1.27	1.75	2.05	2.23
Total projected emissions reductions (not including Clean Air and Climate Change Trust Fund)	3.9	9.0	66.1	71.5	76.8
Results of the Integrated Modelling					
KPIA expected emissions reductions	2	5	62	65	69
Differences between policy-by-policy estimates and integrated modelling	1.9	4.02	4.1	6.5	7.8

stated reductions to the total reductions estimated by the Environment Canada model for all years. The policy-level estimates lead to a larger estimate of total emissions reductions, likely for the combined reasons outlined above. When these policies are jointly implemented in an appropriately chosen model, free-rider effects, rebound effects, and policy interaction effects are implicitly accounted for in the analysis, and the predicted reductions represent incremental changes resulting from the suite of policies. In order to account correctly for the incremental effects of individual policies, these effects must be approximated in some way. The Conclusions and Recommendations section includes a suggestion for an improved reporting methodology.

While the integrated forecast of all policies represents a substantial improvement over the exclusive policy-by-policy evaluation in the 2007 Plan, some additional context would render this year's Plan and future plans more complete. The main conclusion of this section is that the impacts of specific programs should be calculated in such a way as to be compatible with the results of the integrated modelling. It is not correct to expect that the incremental effects of each policy will equal the total effect of the suite of policies. However, ensuring that each policy is evaluated under the same assumptions and underlying trends will add to the analysis. In the Conclusions and Recommendations section of this report, the NRTEE offers advice on calculating policy-by-policy figures to align these more directly with the integrated modelling results and allow for easier and more complete evaluation.

Policy-level evaluations should be conducted so as to attribute only the incremental emissions reductions that the policies can reliably be

expected to generate. Similar to conclusions drawn in the 2007 Response, the NRTEE finds that this standard is not met in the 2008 Plan. In addition to the policy-interaction effects that will be missed when policies are evaluated on an individual basis, free-rider and rebound effect adjustments are omitted from many of the evaluations. As a result of the free-rider effect, the emissions reductions for any given program may be overestimated if at least some portion of the projects financed under an incentive program likely would have occurred without the incentive but are still counted as induced emissions reductions. For example, incentive programs administered under the ecoENERGY for Renewable Power program and the ecoENERGY Retrofit initiative counted all emissions reductions associated with financed projects, rather than only those emissions reductions actually induced by the incentives. While documentation provided by NRCan suggests that reducing free ridership has been considered in the design of the programs, it was not considered in the evaluation of those same programs. The rebound effect occurs when people react to the fact that more-efficient products are cheaper to use (a hybrid car costs less per kilometre driven, while a more efficient washer costs less per load of laundry), resulting in greater use of these products than the less-efficient products they replaced. As such, while there will likely still be emissions reductions, they will likely be smaller than the relative improvement in efficiency. Emissions reductions attributed to regulatory changes have not accounted for the rebound effect. However, it is important to point out that both the integrated modelling and the evaluation of some policies do account for these issues.

Newly provided information in this year's Plan made it possible for the NRTEE to examine a sample of the various information and voluntary reduction programs proposed in the 2008 Plan. Such an analysis was not conducted in the 2007 Response. This report examines three such programs—the only programs claiming significant (>1 Mt in any year) emissions reductions. In all cases examined, the programs likely overestimate emissions reductions. For example, the ecoFREIGHT initiative counts emissions reductions that likely would have occurred anyway as a result of U.S. regulations, while the ecoENERGY for Buildings and Houses and the ecoMOBILITY programs count reductions associated with significant regulatory changes, even though these are only information and voluntary reduction programs.

5.3 *Effectiveness of Measures and Regulations in Meeting Canada's Kyoto Protocol Obligations*

The Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC) commits developed country signatories to emissions reductions based on individual commitments. In order to be considered in compliance with the Kyoto Protocol in terms of total emissions, Canada's emissions must not exceed its total assigned commitment, except where this is offset through the use of approved flexibility mechanisms. These are emissions trading, Joint Implementation (JI), and the Clean Development Mechanism (CDM). Penalties for non-compliance under the Kyoto Protocol lead to more stringent compliance requirements in future commitment periods (i.e., after 2012).

Canada's Kyoto commitment is based on a 6% reduction in emissions relative to 1990 levels. As noted earlier, updated emissions inventory numbers published by Statistics Canada have led to a change in the Kyoto compliance level for Canada. The new figures place Canada's 1990 emissions at 594 Mt, updated from previous figures of 598 Mt. This means that Canada's emissions net of reductions credited through the Kyoto Protocol flexibility mechanisms over the

Table B: Annual Allowable Units, Projected Emissions, and Implied Excess Emissions over the First Commitment Period (2008–2012) Under the Kyoto Protocol

Year	2008	2009	2010	2011	2012
Kyoto Target (2008–2012 avg) (Mt)			558		
Commitment Period Total Allowable Emissions (Mt)			2,792		
Actual Emissions Projections (Mt)	744	760	738	739	752
Average Kyoto Gap (Mt/yr)			189		
Commitment Period Projected Excess Emissions (Mt)			945		

2008 to 2012 period must average 558 Mt, while the 2007 Plan was based on a Kyoto target of 563 Mt. These updated figures imply that, in order to be in compliance with the Kyoto Protocol, slightly lower emissions levels than previously estimated will be required.

Statements and information contained in the government's Plan and elsewhere indicate that the Government of Canada is not pursuing a policy objective of meeting the Kyoto Protocol emissions reductions targets. As set out in the table above, the projected emissions profile described in the 2008 Plan would leave Canada in non-compliance with the Kyoto Protocol. Based on this year's Plan, Canadian emissions would exceed our allowable units by 31.4%, with average excess emissions of 189 Mt/year. As is stated in the government's Plan, the final, actual number cannot be calculated and will not be known until the end of the Kyoto Protocol period.

6. Conclusions and Recommendations

Overall, the NRTEE finds the 2008 Plan a more transparent and accurate representation of projected emission reductions compared with last year's Plan. This year's Plan has been improved by providing integrated modelling results. More detail and information on the assumptions behind its forecasts and policy measures has also been provided. This has made it easier to evaluate the likelihood of projected emission reductions being achieved. This too marks a notable improvement over last year's Plan. Much of this was recommended by the NRTEE in its 2007 Response.

While there is a likelihood that an overestimation of emission reductions is still present, the methodological approach used in the estimation of emissions reductions from policies and measures in the 2008 Plan is an improvement from the 2007 Plan, especially through the inclusion of integrated modelling projections. Similar to last year, the NRTEE notes the problem with how emission reductions attributed to the technology fund are accounted for and presented in the KPIA period. There will be emission reductions from this measure but they will occur for the most part outside the 2007–2012 forecast period. To properly evaluate them as forecast emission reductions, these should therefore be accounted for in the year when they will likely occur and not in the year when the contribution is made to the technology fund. The NRTEE would also like to draw attention to the issue that the integrated modelling assumes that the only domestic offsets to be credited will be from landfill gas offsets,

missing all of the other offsets (e.g., afforestation, fuel switching) that will likely have free-rider and rebound effects.

Several of the individual policy evaluations in the 2008 Plan were improved in response to suggestions set out in last year's NRTEE Response, and while room for increased precision remains, this progress should be recognized. Nevertheless, some problems persist with how individual policy measures are calculated and with their projected emission reductions. Insufficient attention has been paid to the free-ridership and rebound effects for several of the information and incentive measures leading to concerns about additionality and hence, a likely overestimate of emission reductions. Further, estimates of information and voluntary reduction programs are approximated by supposing stringent regulations. While the integrated modelling now addresses some of these effects in the end, the individual policy measures continue to be presented without these sources of overestimation adequately being taken into account.

The challenge of evaluating precise emission reductions from provincial and territorial policies not within the control or accountability of the federal government is also present in the Climate Change Trust Fund. Environment Canada's *Detailed Emissions and Economic Modelling* document attributes a wedge to provincial actions—actions that are in part financed by the trust fund. This is not replicated in the 2008 Plan and should be. A potential improvement for future government KPIA Plans would see the constituent programs in this wedge broken down into those financed and not financed through the trust fund, and the effect of the trust fund reported as the incremental effect of the former. Providing more transparency and detail as to which provincial programs contribute to emissions reductions, and by how much, will add to the reliability of this estimate going forward. The NRTEE recognizes this is not fully within the federal government's control or consistent with provincial and territorial accountabilities for expenditures of trust fund monies, but believes governments at both levels should strive to improve transparency on this front and, as a broad goal, generate better information to inform decision makers in their public policy choices for effective climate policy. The NRTEE's companion report, *Greenhouse Gas Emissions Forecasting – Learning from International Best Practices,* might be useful for decision makers in this respect.

The presentation of new, economy-wide emissions forecasts, particularly the addition of a new Baseline Emissions Pathway, created a challenge for the NRTEE in determining the precise and best reference case from which to conduct an evaluation. It is not clear that a separate baseline is required for the government's KPIA plan. The forecasting work contained in Environment Canada's *Detailed Emissions and Economic Modelling* released in March 2008 reflects the most up-to-date information available in a forecast of Canada's likely emissions profile. It contains reliable and up-to-date assumptions and growth trajectories. Shifting this 2008 baseline forecast downward by 40 Mt, on the basis of new emissions inventory data for a single year to create a new baseline pathway for the purposes of the 2008 Plan as the KPIA requires, leads to questions of discrepancy.

While the Kyoto time frame extends only to 2012, the NRTEE has consistently emphasized that climate change mitigation through emissions reductions is really a long-term problem. Viewing and evaluating forecast emission reductions solely during this short five-year period can be misleading as to their longer-term effect. Including forecasts that go beyond this period, possibly to 2020 (the government's medium-term time frame) and measuring results based on established emission milestones, would allow for a more complete picture of the effectiveness of climate policy measures.

6 Please refer to Section 10 in Appendix A for a detailed discussion of this fund.

Recommendations

The NRTEE acknowledges the improvements in forecasting and methodology and additional transparency provided by the government in the 2008 Plan. These allow for a more effective evaluation. To ensure that future iterations of the KPIA Emissions Pathway reflects the best available estimate of what will be catalogued in future emissions inventories, address remaining inconsistencies between integrated modelling forecasts and individual policy measure projections, and provide greater transparency in forecasting presentation, the NRTEE recommends:

1. That evaluation of climate policies also focus on progress toward the government's stated targets based on a set of actual emission milestones and not just a hypothetical business-as-usual scenario, in recognition that emissions reduction is a long-term policy goal and that policy measures need to be judged in terms of their effectiveness in delivering desired emission levels.
2. That the integrated modelling analysis be extended to generate estimates of the actual incremental effects of each of the individual policy measures on actual emissions in order to generate economy-wide forecasts with and without the measure in place. This will provide a policy-level estimate that accounts for policy interactions, free ridership, rebound effects, and other additionality concerns.
3. That updates to the most current reference case be well documented as in the March 2008 publication of *Detailed Emissions and Economic Modelling*, and should not be combined with reporting under the KPIA.
4. That emission reductions attributed to the technology fund be accounted for in the year they are forecasted to occur rather than in the year in which contributions to the fund are made.
5. That future integrated modeling account for all potential offsets in order to minimize likely rebound and free-rider effects.
6. That only the impacts of announced and reasonably expected provincial actions (including those financed through the Clean Air and Climate Change Trust Fund) be included in modelling of the KPIA Emissions Pathway.
7. That forecasting techniques used continue to strive to meet international best practices, and that the NRTEE's companion report, *Greenhouse Gas Emissions Forecasting – Learning from International Best Practices*, be considered in making improvements in forecasting methodology and governance.

Appendix A:
Analysis and Assessment of Individual Measures with Greater than 1 Tonne of Emissions Reductions in Any Given Year

1. Regulatory Framework for Industrial Greenhouse Gas Emissions

Summary of Initiative and Emissions Projections

The Regulatory Framework for Air Emissions (Canada, 2007b) imposes emissions reductions on Large Final Emitters (LFE) forcing affected firms to achieve an 18% reduction in GHG intensity from 2006 levels beginning in 2010, with a further 2% improvement required in each year thereafter. Affected firms may comply with the regulations either through internal abatement, through contributions to a climate change technology fund (at an initial rate of $15/tonne), by purchasing the right to claim emissions reductions made by other domestic firms through the emissions trading and offset systems, or by purchasing emissions reductions credits through the CDM mechanism defined under the Kyoto Protocol. Firms may also claim a one-time credit for GHG reductions between 1992 and 2006.[7] Emissions reductions attributed to the Regulatory Framework for Air Emissions total 163 Mt over the five-year Kyoto compliance period.

Analysis

Since the 2007 NRTEE Response, much additional information has been provided on the details of the Regulatory Framework. Documents available from Environment Canada now provide details on the modelling used to support the projected emissions reductions as well as regulations determining targets for individual facilities, the offset system, and the credits available for early action. This information provides a more transparent view of the impact of the regulations.

The estimates provided in the 2008 Plan are computed using Environment Canada's E3MC, the model that tests the policy against a reference case and thereby generates an estimate of the incremental impact of the regulatory measures. In the 2007 Response, the NRTEE highlighted a lack of clarity with respect to the treatment of technology fund contributions. In the March 2008 *Detailed Emissions and Economic Modelling*, many of these issues are addressed. In particular, we see how industrial firms are responding to an effective carbon price signal of over $20 per tonne in 2010–2012, which is consistent with the reported investment in compliance, including internal emissions reductions when considering results from the NRTEE's internal modelling and from Jaccard and Rivers (2007). However, an inconsistency remains in the presentation of all compliance mechanisms as immediate emissions reductions.

Technology fund contributions account for a large percentage of firms' predicted actions to comply with regulations under the Framework. In the implementation of E3MC, these contributions are assumed to be the cheapest option available to firms in each period, and so they are used to the maximum allowable level (*Detailed Emissions and Economic Modelling*,

7 With respect to the particular mandate of this study, the provision for early action means that firms can receive credit for emissions reductions already undertaken prior to 2006. It is important to note here that, while these reductions would be credited under the Regulatory Framework against 2010–2012 emissions, they hold no standing with regard to the Kyoto Protocol.

Environment Canada, 2008). The implication is that approximately 20 Mt of emissions per year from 2010 to 2012 will be offset through use of the fund and through credits for early action, or between 70 and 80% of all compliance activities under the large final emitters program.

The contribution rates and overall abatement activities reported by Environment Canada are consistent with existing modelling results for the same policy. Simulations conducted for the NRTEE (2007) and cited in the 2007 NRTEE Response suggest that compliance with the Framework will be achieved through substantial use of the technology fund, with actual emissions reductions on the order of 16–20 Mt in 2010, with small reductions before 2010 as firms act in advance of the regulations, and larger reductions after 2010, up to approximately 25 Mt in 2012.

Contributions to the technology fund will be used to finance future emissions reductions; however there is no guarantee that the quantity of future emissions reductions will be equivalent to the volume of emissions offset by contributions made today, and accounting for them in this way will lead to inaccurate measures of actual emissions. It also makes accounting for future reductions difficult. In the *Detailed Emissions and Economic Modelling* (2008) document, emissions reductions realized from investments in the fund occur after 2016, outside the scope of the present document, and then are expected to "account for another 20 megatonnes" of reductions per year. If these "reductions" are counted in 2010–2012 when the contribution is made, they should not be counted again later. However, it would seem more transparent to account for emissions reductions in the same way in which we account for emissions—in the year in which they occur, not the year in which investments are made.

A concern is the likelihood that the emissions reductions attributed to domestic offset purchases in the 2008 Plan are overestimated. In the KPIA period, it is probable that much of the industrial response to federal climate policy will happen in the form of offsets. Potential offsets in response to industrial regulation could be in landfill gas, no-till farming, afforestation, fugitive emissions, energy efficiency and fuel switching. Yet the integrated modeling of domestic offsets in the 2008 Plan assumes that only landfill gas offsets will occur. This suggests that the modeling could miss the other offsets, leading to free-rider and rebound effects.

As stated in the 2007 NRTEE Response, while the 2008 Plan appears to equate the use of all compliance mechanisms with realized reductions between 2010 and 2012, it is important to note that the lack of realized reductions for the 2008–2009 period is also inconsistent with other modelling outcomes. As firms engage in early action to reduce their eventual compliance costs, some reductions relative to the reference case are likely to occur in the two initial years of the commitment period.

In order to render this reporting consistent, the NRTEE would recommend clarification of the compliance mechanisms used in response to the Regulatory Framework, as was reported in Table B in Section 7.1.4. Information on the predicted volumes of domestic and international offset purchases, early action credits, and technology fund contributions would greatly enhance the clarity of the projections.

Conclusions

The above evidence and analysis suggests uncertainty as to whether or not the Regulatory Framework for Air Emissions will result in significant emissions reductions in the Kyoto timeframe. However, it is also the case that significant improvements in the transparency of the analysis have been made since the 2007 NRTEE Response. The estimates provided do continue to equate the use of any of the compliance mechanisms with emissions

Program	Projected Emissions Reductions in MT					Key Determinants of Results	Key Improvements from 2007	Predictive Accuracy
	2008	2009	2010	2011	2012			
Regulatory Framework for GHG Emissions	0	0	52	55	56	-use of compliance mechanisms treated as emissions reductions	- transparency of the analysis	Likely overestimate of actual reductions

reductions by tabulating contributions to the technology fund as immediately realized emissions reductions. Regardless of the eventual emissions reductions that occur as a result of the fund, it is inconsistent to treat investment in potential future emissions reductions as being equivalent to realized present-day emissions reductions.

2. Energy Efficiency Regulations and Phasing Out Inefficient Incandescent Light Bulbs

Summary of Initiative and Emissions Projections

As part of the Regulatory 2008 Plan, the government proposes to update existing standards for 12 product categories, and introduce new energy efficiency standards for 20 more between 2007 and 2010, as well as introduce a ban on incandescent light bulbs that would begin in 2012.

Analysis

According to the methodological document provided by Natural Resources Canada on the policies and programs it is responsible for in the KPIA Plan, the emissions reductions were calculated through analysis of the market share of products currently permissible that would not be in compliance with the new standard. Assuming that the sales of these products would translate to sales of new appliances meeting the standard, the emissions reductions are calculated. No consideration was explicitly given to the rebound effect, which likely leads to an overestimate in the order of less than 15%. The estimated impact of the ban on incandescent bulbs has been altered from the 2007 numbers to reflect the fact that the ban will not result in immediate replacement of all non-compliant fixtures in 2011, which addresses a key issue raised in the 2007 NRTEE Response.

Reducing emissions by improving efficiency standards targets the capital stock of energy-using appliances. As such, estimates of energy savings must take account of three elements. First, the rate at which the new, more-efficient appliances will replace older, less-efficient models must be calculated. Second, the intensity of use must be compared to the older, less-efficient models. If more-efficient appliances are larger or are used more, the energy savings accruing over a year will be less than the difference in efficiency of the two units. Finally, there is the possibility that the new device will replace the old one, but that the old device will be used elsewhere in the home; this is known as the beer fridge effect. In this case, the purchase of the new appliance will increase household energy consumption. The estimates provided for the emissions reductions from regulatory policies do an excellent job of accounting for the rate of capital turnover, and errors in these estimates in the 2007 Plan have been corrected.

Some concern remains about the correction of estimated impacts for the rebound effect. Documentation obtained from NRCan claims that, "rebound effects are typically quite low for many energy-saving products such as efficient appliances and heating systems, and are partially addressed through broader public messaging on the benefits of reduced energy use." Empirical evidence cited in the 2007 NRTEE Response suggests that the rebound effect is important. For example, a study by Davis (2007) shows that when randomly chosen homeowners are given washers that are on average 48% more efficient in terms of energy use, they washed 5.6% more clothes. And so the total resulting energy (and emissions) reduction is just 42.4% rather than 48%. Additional studies by Hausman (1979), Dubin and McFadden (1984), Dubin (1985), and Dubin, Miedema, and Chandran (1986) show similar patterns of increased usage intensity after the acquisition of more-efficient appliances. While these are small adjustments, they should be part of the analysis. The rebound effect is a natural consequence of an appliance becoming cheaper to use as its efficiency increases. As NRCan documentation suggests, program design and messaging can only partially offset these behavioural changes, and so an adjustment factor should be included to address the residual effect.

The beer-fridge effect is not specifically mentioned in the methodology, and support should be provided for the implicit assumption that these incentives are not altered by regulatory changes. In a study published by Young (2007) using data from a Natural Resources Canada survey, the author finds that "approximately 30% of households surveyed indicated that they operated two or more refrigerators." Young finds that approximately 60% of refrigerators were still functioning when replaced and that one in five of those was kept in use. Young concludes that "of the 1105 beer fridges in use…approximately 20% can reasonably be assumed to be former 'primary' refrigerators that had been replaced," and the majority of these were very inefficient refrigerators over 20 years old. If we consider that one in five "replaced" refrigerators actually leads to increases in total energy use, this would erode some of the reported energy savings. While it is true that refrigerators are only one of the products affected by the new standards, they are significant as they are used continuously, and older models can use over 1500 kWh of electricity per year. The effect may be a non-issue if it can be shown that the replacement rates and rates at which old refrigerators are kept in use remains the same.

A significant proportion of the reductions in 2012 are due to the introduction of a ban on incandescent light bulbs as a driver of increased energy efficiency. In the 2007 NRTEE Response, it was pointed out that estimates of 4.1 Mt of carbon emissions reductions could only be achieved through a complete replacement of all light bulbs on January 1, 2012. This figure has been adjusted in the 2008 Plan to reflect the longer period of capital turnover required to realize all of the reductions.

Conclusions

Given the fact that the estimates provided do not account for the rebound effect of increased intensity of use or increased total appliance stock through the beer-fridge effect, the projected gains from improved standards remain likely overestimates of actual reductions. Corrections for these effects would lead to small changes in the estimated impacts. It is certainly the case that, relative to estimates provided in the 2007 Plan, these estimates represent an improvement in particular as they have adjusted for the capital turnover period required to realize benefits from banning inefficient lighting technologies.

Program	Projected Emissions Reductions in MT					Key Determinants of Results	Key Improvements from 2007	Predictive Accuracy
	2008	2009	2010	2011	2012			
Regulating Energy Efficiency	0.36	0.88	1.23	1.54	4.07	-no rebound effect	-adjusted for capital turnover period to realize benefits from banning inefficient lighting	Likely overestimate

3. Regulating Renewable Fuels Content

Summary of Initiative and Emissions Projections

Regulations will require 5% renewable fuel content by volume for gasoline from 2010 and 2% by volume for diesel fuel and heating oil by no later than 2012.

Analysis

The projections in the 2008 Plan are derived by estimating incremental volumes of biodiesel and ethanol produced, and calculating emission reductions using conversion factors that specify the amount by which total GHG emissions are reduced when gasoline and diesel are produced from biomass rather than from petroleum. The estimates in the 2008 Plan have been adjusted to reflect only incremental volumes produced as a result of the regulation and so have largely addressed concerns about additionality brought forward in the 2007 NRTEE Response.

The government's 2007 Plan provides estimates as to the emissions reductions achieved through meeting the 5% renewable fuels content standard compared with a situation where no renewable fuel production takes place. This represented an overestimate of the incremental effect of the policy as some renewable fuel production is taking place without the regulation. This error has been corrected in the 2008 Plan by reporting reductions based on incremental production required to meet the standard.

In the 2008 Plan, the reported emissions reductions correspond to the incremental volumes of ethanol and biodiesel reported in Table C.

However, as was pointed out in the 2007 NRTEE Response, the magnitude of the emissions reduction factor may be lower than that chosen in the Plan. A study by Farrell et al. (2006) cited in the 2007 Response argues that the impact of switching from gasoline to ethanol has an ambiguous effect on GHG emissions, with potential impacts ranging from a 20% increase to a 32% decrease. Updated estimates published as a correction to the Ferrall et al. article suggest that the best estimate for GHG reductions for corn-based ethanol was 18% below conventional gasoline, but with a possible range of 36% fewer emissions to 29% more emissions.[8] Hill et al. (2006) found similar results for gasoline, and found that greenhouse gas emissions are reduced by 41% for biodiesel relative to the fossil fuels they displace. The emissions reduction factors used in the 2008 Plan amount to 33.1% and 66.5% reductions for gasoline and biodiesel respectively.

8 http://www.sciencemag.org/cgi/content/full/312/5781/1748b

Table C: Baseline and Policy-induced Biofuel Production Levels and Implied Emissions Reductions

Scenario		2008	2009	2010	2011	2012
Federal regulation	Ethanol (ML)	0	0	2100	2150	2200
	Biodiesel (ML)	0	0	0	0	670
Base case	Ethanol (ML)	880	900	1480	1510	1540
	Biodiesel (ML)	100	100	200	200	200
Incremental production	Ethanol (ML)	0	0	620	640	660
	Biodiesel (ML)	0	0	0	0	470
Incremental Emissions reductions from federal regulations	(MT)	0	0	0.8	0.8	1.9

Conclusion

The evidence above suggests that emissions reduction factors used are higher than some of those cited in the current scientific literature. However, the reported emissions reductions in the 2008 Plan are now based on incremental effects of the legislation, and so represent a substantial improvement over those reported in the 2007 Plan. Further support should be provided for the cited emissions reduction factors.

Program	Projected Emissions Reductions in MT					Key Determinants of Results	Key Improvements from 2007	Predictive Accuracy
	2008	2009	2010	2011	2012			
Regulating Renewable Fuels Content	0	0	0.8	0.8	1.9	-renewable fuels' emissions reductions factor	- reductions now based on incremental effects of the legislation	Likely overestimate

4. ecoENERGY for Renewable Power

Summary of Initiative and Emissions Projections

The ecoENERGY for Renewable Power is the latest in a series of incentive programs (previous programs were the Wind Power Production Initiative [WPPI] and the Renewable Power Production Initiative [RPPI]) that provides an incentive of one cent per kilowatt hour for up to ten years to reduce the cost gap between new technologies and traditional sources of electricity.

Analysis

The estimates above have not changed from those provided in the 2007 Plan. These estimates were calculated on the basis of renewable energy supplies of 4.7 TWh in 2008, 8.0 TWh in 2009, 11.7 TWh in 2010, and 14.3 TWh for 2011 and 2012, and the emissions reductions are derived using a conversion factor of 0.4564 Mt/TWh. These do not represent the incremental energy generation caused by the subsidy program—rather these figures represent the total amount of generation occurring in projects financed by the subsidy program. The only case under which these numbers will be an accurate representation of the effect of the program is if none of the financed projects would have been built without the subsidy.

The overestimate here is due to what we have previously defined as the free rider problem associated with subsidies. According to NRCAN (undated), "where a renewable electricity generation project is developed at a site where no previous electrical generation existed, it would clearly be considered 'incremental.'" This does not, however, constitute an appropriate definition of incremental generation for the purposes of evaluating policy-induced emissions reduction. In order for emissions reductions to be clearly attributed to increased renewable generation under the RPPI, it must be demonstrable that either:

1. The production facility would not have been built absent the subsidy, **and** the new facility replaces an existing one with a higher rate of emissions; or,
2. The production facility would have been added absent the subsidy, but the facility would have been more emissions intensive.

Natural Resources Canada has confirmed that all new renewable energy production eligible for financing under the RPPI would be considered as contributing to emissions reductions, thereby ignoring the potential for policy free riders who benefit by receiving the subsidy for projects that would have been built irrespective of it.

A second important source of additionality concern arises as a result of the fact that the original WPPI subsidy is included in the Baseline Emissions Pathway. Any emissions savings resulting from projects initially financed under this initiative (as well as those financed under the expanded WPPI from the 2005 Budget or from the current program) would be double counted if included in the estimates. Figures provided by NRCan in support of the 2007 Plan suggest that emissions reductions are in fact stated for *all* renewable generation that would be eligible for RPPI or WPPI financing as well as that eligible for the EcoENERGY subsidy. Table D below shows the figures provided for the 2007 Response, the 2006 reference case for wind power (other renewables are taken to be negligible, and biomass is not included), and the calculations that led to the stated reductions.

Table D: Emissions Reductions from Renewable Power

Year	2005	2008	2009	2010	2011	2012
Reference Case Wind Production (TWh)[9] (*=interpolated)	**1.8**	**4.76***	**6.58***	**9.1**	**10.6***	**12.5***
NRCan-Provided Total Generation Numbers (TWh)		4.7	8.0	11.7	14.3	14.3
Total Emissions Reductions (multiply total generation by a factor of 0.4564 Mt/TWh)		2.2	3.7	5.3	6.5	6.5
Stated Emissions Reductions		2.2	3.7	5.5	6.7	6.7
Incremental Emissions Reductions		0	0.6	1.2	1.7	1.7
Magnitude of Over-estimate		**2.2**	**3.1**	**4.3**	**5**	**5**

A nearly identical table was included in the analysis of the 2007 Plan, and demonstrates that while the stated emissions reductions suppose a case where, in the absence of the subsidy, all renewable energy would have been built as fossil-fuel-based generation. If we account for the incremental emissions reductions under the projections of new generation, the reductions are smaller. In fact, the size of the overestimate here suggests much of the difference reported between the KPIA Emissions Pathway (net of the accounting for technology fund contributions) and the sum of policy-level analysis may be due to this program. When the integrated model is used, only the incremental renewable power generation will be captured, implicitly correcting for free ridership since the projects that would have occurred absent the regulation will be captured in the Baseline Pathway Emissions.

Conclusions

The sources of overestimation cited in the 2007 NRTEE Response remain in the 2008 Plan for this program. Figures in the Plan do not represent incremental reductions in GHG emissions that will occur as a result of the policy. Rather, they represent an estimate of the emissions reductions occurring as a result of all renewable power in Canada, implicitly assuming that none of this would have been built without the subsidy, and that the same amount of power generation would have been built using an average mix of generation fuels.

9 Reference case emissions are smoothed between years by assuming constant emissions growth rates between 2006 and 2010, and again between 2010 and 2015.

Program	Projected Emissions Reductions in MT					Key Determinants of Results	Key Improvements from 2007	Predictive Accuracy
	2008	2009	2010	2011	2012			
ecoENERGY for Renewable Power	2.2	3.7	5.5	6.7	6.7	-actual displacement of existing capacity -nature of displaced alternative -additionality -free ridership	- sources of overestimation remain the same	Likely overestimate

5. ecoENERGY for Buildings and Houses

Summary of Initiative

The ecoENERGY for Buildings and Houses program is an information-based initiative offering training, labelling, and rating of houses and buildings.

Analysis

The bulk of emissions savings attributed to this program come through assumed changes in commercial building codes driven through the adoption of a non-binding updated *Model National Energy Code for Buildings* (MNECB) and through the impacts of disseminating energy-efficient home building practices through labelling.

Changes to the building code to increase energy efficiency requirements can certainly reduce emissions, but these are within provincial jurisdiction. In the 2008 Plan, details are provided indicating that four provinces are currently running pilot projects relating to the building code, while six have announced changes to the building code to require an EnerGuide rating of 80—the EnerGuide labelling standard recommended in the updated *Model National Energy Code for Buildings*, which is part of this program. According to information provided to the NRTEE by NRCan, the emissions reductions associated with this program are calculated by implicitly assuming that the labelling drives changes in provincial building codes as follows:

1. The energy intensity of average new construction is assumed to be 1.55 GJ/m2 based on program experience;
2. It is assumed that an updated MNECB. will target an energy intensity performance of 1.0 GJ/m2 for new construction, which generates energy intensity savings of 0.55 GJ/m2;
3. The difference in energy savings is then multiplied by new construction floor space, estimated to be 8.5 million square metres.

The methodology document provided to the NRTEE by NRCan stipulates that realizing the overall savings estimate is contingent on adoption by all provincial/territorial jurisdictions by 2010–2011. Building code changes requiring a 36% improvement in average energy intensity while making use of a labelling standard are major regulatory changes, and are not the sole result of information programs.

It is true that some provinces are enacting building code changes as part of their climate change policies. For example, in Nova Scotia,

new homes would be required to display an EnerGuide rating by 2008, while minimum standards would require a rating of 72 by 2009 and 77 by 2010, and 80 by 2011. However, this analysis raises three concerns. First, and most obviously, major changes to the building code requiring an immediate implementation of EnerGuide 80 ratings are not going to be in place in all provinces by 2008–2012. Second, even if the regulatory changes were to be made, it would be difficult to attribute the emissions reductions resulting from these changes to a program that provides the labels and training, but does not enforce the regulation. Finally, the 2008 Plan accounts separately for provincial initiative and climate targets in setting its Baseline Emissions Pathway. Therefore, impacts resulting from provincial-level policy changes should also be omitted from policy-by-policy analysis.

A second source of emissions reductions in the calculation is subject to concerns about additionality. Labelling of houses with respect both to the R-2000 standard and EnerGuide rating system is handled under this program. Information provided to the NRTEE by NRCan states that in order to calculate energy savings from this aspect of the program, "the expected energy savings per house are calculated by comparing the energy consumption of code-compliant average new construction with the energy consumption of rated houses under the two categories of labelling for energy efficient new homes (i.e., R-2000 and EnerGuide rating system). Data … shows that a basic EnerGuide-labelled new house saves an average 33 GJ per year over conventional new construction …and an R-2000-labelled house (average EnerGuide rating 82) saves 60 GJ per year compared to conventional new construction. To obtain the total energy savings, the savings per house described above is then multiplied by the number of houses expected to be built." This implicitly assumes that, absent the administration of the labelling program, no houses would be built to higher levels of energy efficiency. Attributing the effect of all new, energy efficient construction to a program that provides a particular label and standard is likely to overestimate the induced emissions reductions.

Conclusion

Information programs are difficult to assess, however, in this case the assumptions made are likely to over-estimate the program's impact. While the program provides only information and labelling, the estimated emissions reductions are based in part on significant changes to building codes being implemented in all provinces. It is true that some provinces have changed or will change current building codes to include more stringent requirements based on the EnerGuide labelling system; however, this does not imply that the existence of the labels and associated information has led to all of these changes. Further, the program attributes energy savings from all new homes built to R-2000 standards to the program, which ignores the possibility that some houses are built to higher standards of energy efficiency due to other factors such as high energy prices and not solely as a result of the label. The estimated impacts thus do not accurately reflect, but rather overestimate, the impact of this labelling, training, and information program.

Program	Projected Emissions Reductions in MT					Key Determinants of Results	Key Improvements from 2007	Predictive Accuracy
	2008	2009	2010	2011	2012			
ecoENERGY for Buildings and Houses	0.32	0.56	1.13	1.57	2.02	- program offers information, while estimated reductions are based on significant regulatory changes in all provinces.	Not assessed in 2007	Likely overestimate

6. ecoENERGY Retrofit Initiative

Summary of Initiative and Emissions Projections

The ecoENERGY Retrofit Initiative is a program that offers subsidies to owners of homes and small- to medium-sized businesses upon completion of retrofits that verifiably improve the energy-efficiency rating of the building. The Plan projects reductions resulting from this program of 440 kt in 2008 up to 1 Mt in 2012, or roughly 250 kt per cumulative-program-year of emissions savings. These estimates have not changed from those published in the 2007 Plan.

Analysis

Reductions are calculated based on differences between the forecasted energy consumption with and without all retrofits financed through the program. Forecast energy savings based on realized energy audits are then converted to emissions savings using emissions factors. The NRTEE was provided with significantly more information on the methodology used to calculate these figures; however significant concerns relating to the free-rider problem remain.

Documents provided by NRCan state that "when designing its ecoENERGY programs, NRCan addressed free ridership by setting hurdle rates for program participants and requiring significant investment on the part of the individual. These program requirements substantially reduce the potential for free ridership." It is true that program design consideration can reduce the potential for free ridership, however these are unlikely to be 100% successful. As a subsidy program requires a greater and greater investment on the part of the grant-receiver, this does not, in and of itself, indicate that the receiver was less likely to have made the change absent the grant—in fact, it might be that the opposite is true. If a homeowner has to undertake a $15,000 renovation to obtain a $1,000 grant, it is unlikely that all renovations are the direct result of the grant program. To avoid double counting of emissions reductions that would have occurred in the absence of the program, an adjustment factor should be added to the estimates. For example, in Carpenter and Chester (1984), results show that over 90% of homeowners receiving the U.S. Conservation Tax Credit for home retrofits would have made the changes without the tax credit. In NRTEE (2006), estimates are reported for free ridership of between 40 and 80% of subsidy recipients. These figures were reported in the 2007 NRTEE response but not taken into account in the program-by-program estimates provided by NRCan for the 2008 Plan.

In fact, the NRCan statement highlights a further potential problem with the way in which emissions reductions are calculated for the EcoENERGY retrofit. While the homeowner finances a substantial portion of the retrofit, the energy savings are calculated on the basis of energy audits performed before and after all renovations are complete. The implicit assumption is that none of the improvements would have happened absent the incentive program.

A smaller issue that was raised in the 2007 Response is the fact that, as retrofit subsidies reward retrofits for efficiency, they do not directly reward diminished total energy consumption. In fact, they may provide an incentive to increase the intensity of use or the total number of certain energy durables (through the rebound effect). In the 2007 NRTEE Response, a study by Dubin, Miedema and Chandran (1986) was highlighted that showed that, for a similar program, actual energy savings from the installation of new cooling technologies would be as much as 13% below engineering estimates on average. For heating, energy savings 8–12% below engineering estimates were found. The NRTEE 2007 Response also highlighted that for a previous NRCan program, predicted emissions savings resulting from renovations was 4 tonnes, while the average realized emissions savings was found to be 1.4 tons per household, or less than half of the predicted savings at the time.[10]

Conclusions

The estimates in the 2008 Plan claim all of the energy savings from all retrofits receiving financing. The implicit assumption is that all of these retrofits occur because of the subsidy—that there are no free riders. Further, the estimates in the Plan directly translate forecast energy efficiency gains into emissions reductions, without explicitly accounting for rebound effects. The resulting emissions reductions will therefore likely be overestimated.

Program	Projected Emissions Reductions in MT					Key Determinants of Results	Key Improvements from 2007	Predictive Accuracy
	2008	2009	2010	2011	2012			
ecoENERGY Retrofit	0.4	0.7	0.9	1	1	-treatment of free-ridership -conversion of predicted energy savings to realized emissions reductions - rebound effect	- sources of overestimation remain the same	Likely overestimate

10 See http://www2cm.nrcan.gc.ca/nrcan/index_e.aspx?DetailID=57 and http://www2.nrcan.gc.ca/dmo/aeb/english/ReportDetail.asp?x=135&type=rpt

7. ecoMOBILITY Initiative

Summary of Initiative

The ecoMOBILITY program is an information program designed to increase municipal capacity to combine transportation demand management policies, programs, and services with major infrastructure investments under federal infrastructure funding initiatives.

Analysis

To calculate emissions reductions, it was assumed that the information provided would reduce the vehicle kilometres (VKT) travelled by passenger vehicles in urban areas by 3% by 2010. This assumption came from the "high Transport Demand Management" option used in a study commissioned by Transport Canada ("*The Impact of Transit Improvements on GHG Emissions: A National Perspective*," Transport Canada, March 2005. See http://dsp-psd.pwgsc.gc.ca/Collection/T22-134-2005E.pdf). The 3% reduction was applied to historical VKT data available from NRCan to obtain the resulting reductions in fuel use, which were then converted to greenhouse gas emission reductions using the conversion factors published by Environment Canada.

As discussed in the 2007 NRTEE response, information programs are difficult to evaluate. The EcoMOBILITY program claims to achieve cumulative emissions reductions of more than 6 Mt within the Kyoto period for an investment of $10 million—a rather low $1.61 per tonne. Further, the 3% reduction in VKT is roughly equivalent to the effect on U.S. transportation demand of the recent run-up in world oil prices that have increased the price of gasoline by over 50%. It seems unlikely that the provision of information with a $10 million budget could have a similar effect.

In fact, while the estimates used above equate the $10 million over four years to "high transportation demand management (High TDM)," *The Impact of Transit Improvements on GHG Emissions: A National Perspective* defines High TDM programs specifically as disincentive, not information programs, and provides examples of such policies including:

- Parking management
  - Limited supply of long-term parking
  - Higher and more extensive parking charges
- Road pricing (i.e., tolls)
- Institutional measures
- Trip reduction by-laws
- Bicycle parking by-laws
- Distance-based vehicle insurance
- Taxes and fees on vehicle ownership
- Fuel taxes

Conclusions

Clearly, the 3% reduction attributed to High TDM programs has a suite of measures in mind that outstrip the provision of information, which "makes it easier to adopt (less GHG-intensive) transportation choices." As a result, one can conclude that a 3% reduction in vehicle kilometres travelled will not occur in response to the provision of information under the ecoMOBILITY program.

Program	Projected Emissions Reductions in MT					Key Determinants of Results	Key Improvements from 2007	Predictive Accuracy
	2008	2009	2010	2011	2012			
ecoMOBILITY Initiative	0	1.24	1.63	1.65	1.68	Emissions reductions based on effects of more aggressive disincentive policies, not information programs	Not assessed in 2007	Likely overestimate

8. ecoFREIGHT Program

Summary of Initiative

The ecoFREIGHT Program is a voluntary initiative described as programs that build and maintain partnerships within the transportation sector. Part of the program consists of a memorandum of understanding between the rail and air freight industry associations.

Analysis

The emissions reductions associated with the ecoFREIGHT program have not changed from the 2007 Plan with the exception that no emissions reductions are attributed to the program in 2008, a reflection of a delay in the rollout of the program.

Evaluating impacts of information and voluntary programs is very difficult. In either case, determining the incremental impact of the program requires strong assumptions about what would have happened absent the program, as specific action are neither incented through subsidies, disincented through fees, or forced through regulation. For example, under the EcoFREIGHT partnership program the additionality of projects undertaken under the Memoranda of Understanding (MOU) is questionable. For example, in the rail industry (see http://www.tc.gc.ca/mediaroom/backgrounders/b07-M003.htm), pledges include:

- buying only new and freshly manufactured locomotives that meet United States Environmental Protection Agency (EPA) emissions standards;
- retiring 130 medium-horsepower locomotives built between 1973 and 1999;
- upgrading, upon remanufacturing, all high-horsepower locomotives to EPA emissions standards; and
- upgrading, upon remanufacturing, all medium-horsepower locomotives built after 1972 to EPA emissions standards.

Questions of additionality arise here for two reasons. First, no detail is provided as to how many locomotives would have been retired absent the MOU—i.e., are the 130 retirements incremental or total? Second, we would ask if there are reasons other than the MOU to meet EPA emissions standards. In fact, the 2008 EPA legislation (see http://www.epa.gov/otaq/regs/nonroad/420f08004.pdf) requires that all remanufactured locomotives used extensively in the U.S. meet their new emissions standards if built after 1972. Therefore, as many Canadian locomotives are used within the U.S., the last

Program	Projected Emissions Reductions in MT					Key Determinants of Results	Key Improvements from 2007	Predictive Accuracy
	2008	2009	2010	2011	2012			
ecoFREIGHT Program	0	0.65	1.19	1.22	1.26	- many of the changes likely made in response to EPA regulations, not Canadian government programs	Not assessed in 2007	Likely overestimate

two of these changes above would likely have been made absent the MOU, and therefore are a result of U.S. government actions, not actions of the Canadian government.

However, since these regulations were enacted in March 2008, and the MOU was only signed in May 2007, incremental emissions reductions resulting from U.S. regulations may not have been included in the reference case.

Conclusion

The NRTEE recognizes that information programs are difficult to assess. As an example of a potential problem, we argue that the actions taken under the MOU may result in emissions reductions, but the evidence presented above suggests that many of these actions would have been undertaken regardless as a result of stringent U.S. regulations. The emissions reductions are attributed to a relatively low-cost, voluntary program. The MOU program should only be credited with their incremental effect over and above the EPA regulations; however, it should be made clear whether the effect of the EPA regulations is or is not included in the reference case. The standard for attributing emissions reductions to voluntary or information programs must be the provision of clear evidence that the actions taken would not have happened without the program, and that is not provided here.

9. ecoAUTO Incentives and the Green Levy

Summary of Initiative

The 2008 Plan details the effects of the ecoAUTO new-vehicle-purchase incentive program and the Green Levy program, which respectively offer rebates or charge additional fees to new vehicles based on their relative fuel economy. Under the program, purchasers may be eligible for rebates on fuel-efficient vehicles of up to $2,000, or be charged fees of up to $4,000 on new fuel-inefficient vehicles.

Analysis

In the 2007 NRTEE response, it was determined that the estimates for the EcoAUTO Incentives and the Green Levy represented likely overestimates of the induced emissions reductions. This was a result of methodological clarification that suggested that the emissions reductions attributed to the levy and the incentive corresponded to the lifetime vehicle emissions reductions associated with a vehicle purchased under the program. While this would be a reliable measure of program impacts, treating the total of all future emissions reductions as though the reductions occurred when the vehicle is sold were not consistent with

Program	Projected Emissions Reductions in MT					Key Determinants of Results	Key Improvements from 2007	Predictive Accuracy
	2008	2009	2010	2011	2012			
EcoAUTO Incentives and the Green Levy	0.1	0.2	0.2	0.2	0.3	- demand and supply model of vehicle sales and innovation	- modelling ensures rebound and free-rider effects taken into account	Reliable estimate

the accounting principles applied to other programs, and were not consistent with the Kyoto Protocol.

In answer to the 2007 NRTEE Response, and in support of the figures published in the 2008 Plan, further clarification was provided by Transport Canada to the NRTEE. Figures in the 2008 Plan are based on the incremental emissions reductions as predicted by a model of North American vehicle supply and demand. Within the model, adjustments are made for the rebound effect, in that more fuel efficient vehicles are assumed to be driven greater distances. Further, as the estimates are based on the differences in predicted emissions using the same model with and without the policy imposed, free rider effects are corrected implicitly. As with any modelling, the estimates of actual emissions pathways are subject to various assumptions about future technology being realized, but the policy impacts calculated are likely robust to most of these sources of error in the short term.

Conclusion

The impacts attributed to the ecoAUTO incentive and the Green Levy in the 2008 Plan each represent reliable estimates of the impacts of these policies.

10. Clean Air and Climate Change Trust Fund

The 2008 Plan maintains the previous estimate that $1.519 billion provided by the federal government to the provinces and territories through the Clean Air and Climate Change Trust Fund should generate emission reductions of approximately 16 Mt per year for the years 2008–2012.

The estimates are based on the projected rate of return of funding in terms of emissions reductions in Quebec. The Government of Quebec's June 2006 climate change plan credited federal funding of $328 million with generating 3.8 Mt of emissions reductions per year. According to Environment Canada, "it was assumed that the tonne per $ reduction estimated by the Government of Quebec would hold (approximately) for projects in other provinces (3.8 Mt/$328 million = 0.012 tonne per $). Applying this factor to the $1.519 billion the federal government has provided provinces and territories through the Clean Air and Climate Change Trust Fund, generates an emission reductions estimate of 17.6 Mt."

In the 2007 NRTEE Response, the investment of $1.519 billion was found to be generating emissions reductions at average costs of $19 per ton. If some policies have longer-term results, the average dollars per ton will be less than $19. Modelling completed for the NRTEE in the

context of the present study suggests that the total emissions reductions from Canadian industry, households, and the transportation sector would be 16–20 Mt if an emissions price of $19 per tonne were imposed. This figure represents, arguably, the most cost-effective way of achieving a comparable number of emissions reductions.

The effect of the Clean Air and Climate Change Trust Fund will be difficult to measure. In the 2007 Plan, this was treated as a reliable estimate that could be subtracted from the reference case emissions. In 2008, the integrated modelling ensures this is no longer the case. However, the effect of provincial actions is measurable using the model—in the *Detailed Emissions and Economic Modelling* document, a wedge is attributed to provincial actions—actions that are in part financed by the trust fund. A potential improvement for future government KPIA Plans would see the constituent programs in this wedge broken down into those financed and not financed through the trust fund, and the effect of the trust fund reported as the incremental effect of the former.

Appendix B:
Description of Additionality, Free Ridership, Rebound Effect, and Policy Interaction Effects

In its 2007 KPIA Response, the NRTEE found four key reasons the emissions reductions were overestimated in the government's 2007 KPIA Plan. First, the estimates of the reductions generated by the various initiatives suffered from biases related to additionality (including additionality concerns resulting from a lack of accounting for free ridership). Second, the emissions-reduction factors used in the calculations were, in some cases, not consistent with recent scientific evidence. Third, rebound effects were not always taken into account in the estimates. Finally, policies were treated independently, so policy-interaction effects were ignored.

Problems of additionality arise when the stated emissions reductions do not reflect the difference in emissions between equivalent scenarios with and without the initiative in question. If emissions reductions from an initiative have already been included in the reference case, these emissions reductions will be double counted.

A key source of additionality issues that arises frequently and so was treated separately in the NRTEE's 2007 KPIA analysis is the failure to account for free ridership. Free ridership is not properly accounted for when stated reductions include the results of behaviour that is rewarded but not influenced by the policies. This can occur when subsidies are paid to all purchasers of an item, regardless of whether they purchased the item because of the subsidy. Those who would have purchased the product regardless are termed free riders, and their behaviour (since it would have happened regardless of the policies) has already been accounted for in the reference case. Not correcting for this implies that induced emissions reductions will be overestimated by the proportion of free riders, which has been estimated to be between 40% and 80% (NRTEE, 2006).

An emissions-reduction factor is a multiplier that is applied to transform data on activity levels into data on emissions reductions. Activity levels include such measures as renewable power generation, gasoline production from ethanol, etc. In this report, units are expressed as Mt of emissions reductions attributable per change in relevant output (kWh, litres of fuel, etc.). Where possible, it is preferable to compare the factors used in the Plan with those used in the scientific literature.

The rebound effect describes the increased use of a more efficient product resulting from the implied decrease in the price of use: for example, a more efficient car is cheaper to drive and so people may drive more. While estimates vary, emissions reductions will generally be overestimated by between 5% and 20% if estimates do not account for increased consumption due to the rebound effect.

The relative successes of emissions-control policies will be interdependent, and an evaluation framework that takes this into account is important for proper interpretation of stated results. The 2007 Government KPIA Plan provides results from separate evaluations of individual policies, while these are slated to be imposed simultaneously. This approach omits any policy interaction effects and will only be accurate when the sum of all individual policy effects is equal to the total effect of all policies, which is not likely to be the case. A general finding of the NRTEE's 2007 KPIA Response, which is consistent with the statement above, is that in order to deliver a statement of total expected emissions reductions, all policies should be imposed simultaneously in a modelled economy.

Appendix C:
Detailed Description and Comparison of the Baseline Emissions Pathway and the KPIA Emissions Pathway

Baseline Emissions Pathway

A significant change in the interpretation of the published reductions in the 2008 Plan results from the introduction of a new reference scenario, termed the Baseline Emissions Pathway. Environment Canada developed the scenario using its Energy-Economy-Environment Model for Canada, or E3MC. This baseline represents a significant change from the 2006 NRCan reference case used in the 2007 Plan, and a significant reduction in the baseline emissions against which policies are implemented.

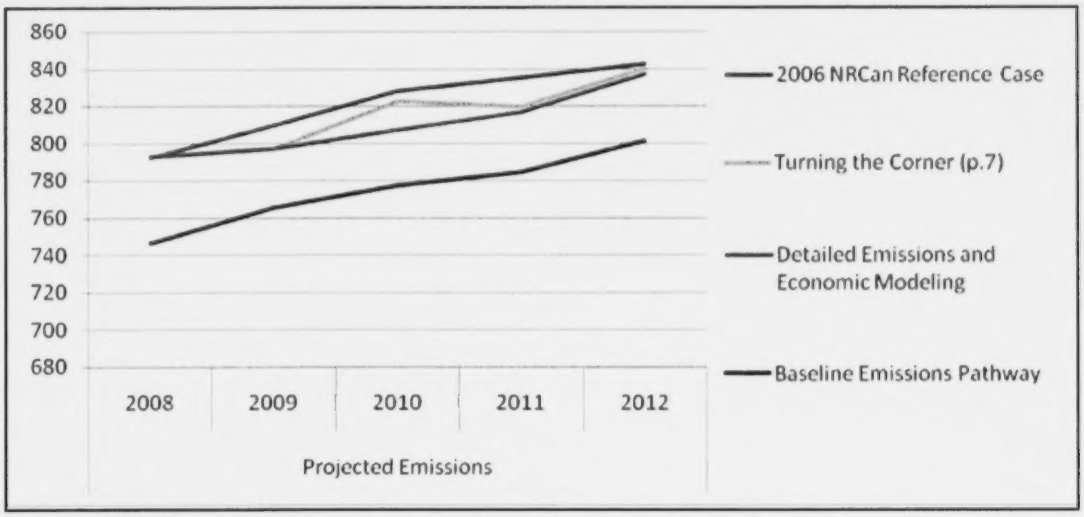
In March 2008, a new Business-as-usual or reference case, different from the 2008 Plan's Baseline Emissions Pathway, was published for Canada in Environment Canada's *Detailed Emissions and Economic Modelling*. According to that document, this new forecast reflected "the best available information about economic growth as well as energy demand and supply into the future." Economic projections for the forecast were developed by Informetrica Limited, having been calibrated to the long-term economic forecast put forward by Finance Canada. These economic forecasts were used as the basis for emissions forecasts computed using Environment Canada's E3MC. This new reference case (March 2008) represents an updated alternative to the 2006 NRCan reference case used in the 2007 KPIA Plan, as it reflects new information relevant to the Canadian economy including forecasts of oil prices, oil sands development, and electricity production. As shown in Figure 3, this new reference case (from *Detailed Emissions and Economic Modelling*) predicted a slower near-term rise in emissions followed by a sharper rise in later years.

In the 2008 Plan, a new reference case is presented that modifies the March 2008 Environment Canada forecast. As shown in Figure 3, the Baseline Emissions Pathway predicts emissions under no policy intervention that are significantly lower than the Environment Canada reference case developed in *Detailed Emissions and Economic Modelling*.[11]

It is of key importance to understand why the starting point for the integrated modelling in the KPIA Plan, the Baseline Emissions Pathway, represents a much lower emissions trajectory than has previously been put forward for Canada. The change in the Baseline Emissions Pathway is due to an adjustment made to account for updated emissions inventory data provided to Environment Canada by Statistics Canada. While the March 2008 reference case published by Environment Canada had projected 2006 emissions at 760 Mt (see *Detailed Emissions and Economic Modelling*), the new inventory data from Statistics Canada estimated 2006 emissions inventories at 721 Mt, a sharp drop from 747 Mt in 2005 as opposed to the predicted increase. Given this new information, Environment Canada adjusted its Baseline Emissions Pathway to reflect 2006 emissions inventories, which is reflected in the downward shift in emissions profiles between that reported in *Detailed Emissions and Economic Modelling* and that

11 To calculate the reference case, the emissions levels represented on the top line of the wedge diagram on page 7 of Turning the Corner (2007) and the reference case path given on page 3 of *Detailed Emissions and Economic Modelling* (2008) were interpolated from the provided diagrams. In the first case, the top line in the wedge diagram is be taken to represent expected emissions with no provincial or territorial actions, without a clean electricity regulation, and with no federal actions.

Figure 3: Reference Cases and the Baseline Pathway Emissions



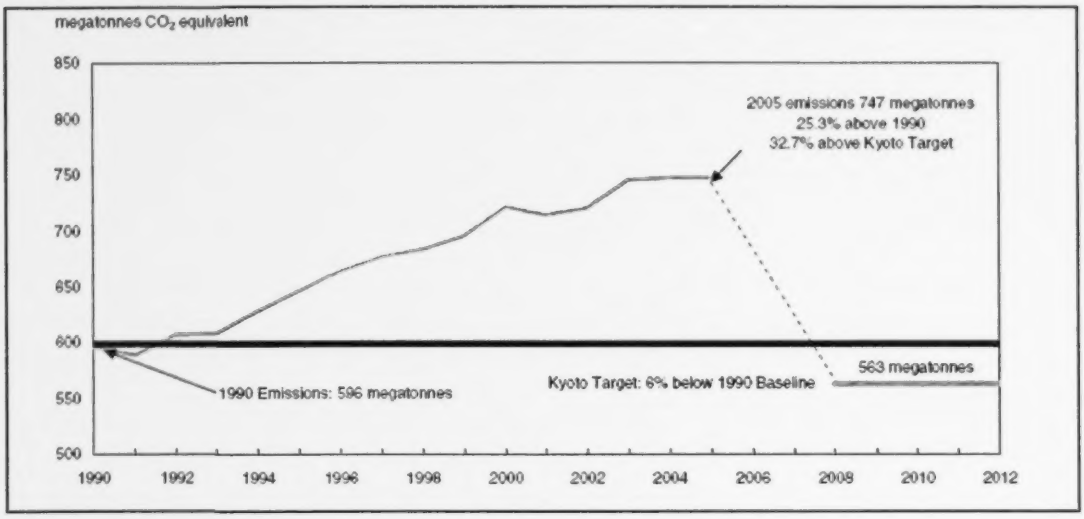
reported in the Baseline Emissions Pathway shown above. This downward shift in 2006 emissions inventories is consistent with other data collected by Environment Canada for 2006. Among reporting facilities under the Facility Greenhouse Gas Emissions Reporting Program, emissions dropped by 2.3% in 2006 compared with 2005. This decrease, extended over the entire economy, would be equivalent to comparable emissions levels of 729 Mt. However, there were several mitigating factors that should be considered in this year. Most notably, 2006 was a warmer year than normal and so fewer emissions resulted from home heating. However, even though the KPIA requires the government to base its forecast on the most recent emissions inventory for Canada, the NRTEE does not believe the entire forecast should be shifted down by 40+ Mt on the basis of emissions inventory data for a single year as it might serve to marginalize the quality of the previous forecasts.

The mandate of the NRTEE with respect to the KPIA is to analyze the stated policy impacts as well as the expected emissions profile. When forecasting policy impacts, the key component is to determine whether the policy impacts are incremental relative to a clearly defined business-as-usual scenario, which is provided in the 2008 Plan in contrast to the 2007 Plan in which the baseline emissions were implicitly but not explicitly based on the NRCan (2006) Reference Case. As such, the additional detail and transparency of the baseline in the 2008 Plan represents a substantial improvement over the 2007 Plan. However, a forecast based on the well-documented projections produced in Environment Canada's March 2008 report *Detailed Emissions and Economic Modelling* would have added further to the NRTEE's ability to interpret the outcomes of the government's policies and measures as laid out in its 2008 Plan.

KPIA Emissions Pathway

The KPIA Emissions Pathway is to be interpreted as a forecast of what will occur when all the policies proposed in the 2008 Plan are put in place simultaneously. The effects of the policies were simulated using Environment Canada's E3MC, the same model as was used to

Figure 4: Canada's Actual GHG Emissions, 1990-2005 (Source: Statistics Canada, 2008)



calculate the Baseline Pathway Emissions under the same assumptions about growth trends and provincial actions discussed above. As such, concerns raised by the NRTEE in its 2007 Response regarding additionality issues and policy interactions are taken into account—the outcome will reflect the fact that policies may enhance or detract from the effects of each other. This is an important change and improvement from the 2007 Plan which did not contain any integrated modelling. An exception, however, is the exclusion of all domestic offsets apart from landfill gas in the integrated modelling. The above issues are not taken into account in this respect.

Before examining the projection itself, a factor that has significant influence on the interpretation of the KPIA Emissions Pathway is the way in which compliance mechanisms allowed for under the Regulatory Framework for Industrial Greenhouse Gas Emissions are treated. The KPIA Emissions Pathway reports regulatory emissions—the total emissions not offset by regulatory provisions—a definition which implies that the Pathway does not represent an actual emissions trajectory. Further explanation of this point of interpretation is provided below.

Under the Regulatory Framework for Industrial Greenhouse Gas Emissions, firms may use one of several mechanisms to comply with their targets, and only some of these represent actual reductions in emissions. Of particular importance here is the treatment of the technology fund. It allows firms the options to pay a fixed price to purchase the right to emit in any given year. Importantly, firms are paying for the right to emit—they are not reducing emissions. Consider the following scenario. A firm is facing an emissions target under the Framework of 10Mt/year. If its emissions in the year in question are 11Mt, it may remit to the government a contribution of $15/ton, or $15 million to offset its excess emissions. From a regulatory compliance perspective, the firm's emissions are now 10Mt as it has exercised one of the compliance mechanisms. Actual emissions—those going up the smokestack, so to speak—remain at 11Mt. In the KPIA Emissions Pathway, this would be reported as annual emissions of 10Mt. If the $15 million contribution generates exactly one 1Mt of

emissions reductions at some point in the future, then the effect of this accounting discrepancy is only one of timing; however, it would appear to be more transparent to report expected actual emissions, with a footnote stating to what degree technology fund revenue, which should be on the order of $300+ million per year, is expected to generate future emissions reductions. The 2008 Plan acknowledges this discrepancy in a footnote on page 24: "actual emissions levels will depend on compliance options chosen by the firm."

Contributions to the technology fund will be used to finance future emissions reductions. Importantly, there is no guarantee that the quantity of future emissions reductions will be equivalent to the volume of emissions offset today. In fact, in *Detailed Emissions and Economic Modelling* (2008), it is clear that emissions reductions are not realized from investments in the fund until 2016, outside the scope of the present document, and then are only expected to "account for another 20 megatonnes" per year.

Other than the method of accounting for technology fund contributions, the modelling represents an accurate estimate of the outcomes of the policies. As with any model, some assumptions may be less realistic than others, but these assumptions are clearly stated in the *Detailed Emissions and Economic Modelling* document, which allows the estimates to be interpreted with the assumptions in mind.

Appendix D:
Kyoto Protocol Implementation Act (C-288)

Kyoto Protocol Implementation Act (2007, c. 30)
Disclaimer: This document is not the official version.
Act current to September 21st, 2007
Attention: See coming into force provision and notes, where applicable.

Kyoto Protocol Implementation Act

2007, c. 30

K-9.5

[Assented to June 22nd, 2007]

An Act to ensure Canada meets its global climate change obligations under the Kyoto Protocol

Preamble

Recognizing that

Canadians have a deep pride in their natural environment, and in being responsible stewards of their land,

Canada is committed to the principle of environmentally sustainable development,

a healthy economy and a healthy society depend on a healthy environment,

Canadians want to take responsibility for their environmental problems, and not pass those problems on to future generations,

global climate change is one of the most serious threats facing humanity and Canada, and poses significant risks to our environment, economy, society and human health,

the national science academies of Canada, Brazil, China, France, Germany, India, Italy, Japan, Russia, the United Kingdom and the United States declared the following in June 2005: "The scientific understanding of climate change is now sufficiently clear to justify nations taking prompt action. It is vital that all nations identify cost-effective steps that they can take now, to contribute to substantial and long-term reduction in net global greenhouse gas emissions.",

climate change is a global problem that crosses national borders,

Canada has a clear responsibility to take action on climate change, given that our per capita greenhouse gas emissions and wealth are among the highest in the world, and that some of the most severe impacts of climate change are already unfolding in Canada, particularly in the Arctic,

the objective of the United Nations Framework Convention on Climate Change (UNFCCC) is "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system",

Canada has ratified the UNFCCC, which entered into force in 1994,

the Kyoto Protocol requires that Canada reduce its average annual greenhouse gas emissions during the period 2008-2012 to six per cent below their level in 1990,

Canada ratified the Kyoto Protocol in 2002 following a majority vote in Parliament, and the Protocol entered into force in 2005,

this legislation is intended to meet, in part, Canada's obligations under the UNFCCC and the Kyoto Protocol, and

the problem of climate change requires immediate action by all governments in Canada as well as by corporations and individual Canadians,

NOW, THEREFORE, Her Majesty, by and with the advice and consent of the Senate and House of Commons of Canada enacts as follows:

SHORT TITLE

Short title

1. This Act may be cited as the Kyoto Protocol Implementation Act.

INTERPRETATION

Definitions

2. The definitions in this section apply in this Act.

"Climate Change Plan"
«Plan sur les changements climatiques »

"Climate Change Plan" means a plan that meets the conditions set out in section 5.

"greenhouse gas"
«gaz à effet de serre »

"greenhouse gas" means one of the greenhouse gases listed in Annex A to the Kyoto Protocol.

"Kyoto Protocol"
«Protocole de Kyoto »

"Kyoto Protocol" means the Kyoto Protocol to the United Nations Framework Convention on Climate Change, agreed to on December 11, 1997 at Kyoto, Japan, and ratified by Canada on December 17, 2002, as amended from time to time, to the extent that the amendment is binding on Canada.

"Minister"
«ministre »

"Minister" means the Minister of the Environment.

PURPOSE

Purpose

3. The purpose of this Act is to ensure that Canada takes effective and timely action to meet its obligations under the Kyoto Protocol and help address the problem of global climate change.

HER MAJESTY

Binding on Her Majesty

4. This Act is binding on Her Majesty in Right of Canada.

CLIMATE CHANGE PLAN

Climate Change Plan

5. (1) Within 60 days after this Act comes into force and not later than May 31 of every year thereafter until 2013, the Minister shall prepare a Climate Change Plan that includes

(a) a description of the measures to be taken to ensure that Canada meets its obligations under Article 3, paragraph 1, of the Kyoto Protocol, including measures respecting

(i) regulated emission limits and performance standards,

(ii) market-based mechanisms such as emissions trading or offsets,

(iii) spending or fiscal measures or incentives,

(iii.1) a just transition for workers affected by greenhouse gas emission reductions, and

(iv) cooperative measures or agreements with provinces, territories or other governments;

(b) for each measure referred to in paragraph (a),

(i) the date on which it will come into effect, and

(ii) the amount of greenhouse gas emission reductions that have resulted or are expected to result for each year up to and including 2012, compared to the levels in the most recently available emission inventory for Canada;

(c) the projected greenhouse gas emission level in Canada for each year from 2008 to 2012, taking into account the measures referred to in paragraph (a), and a comparison of those levels with Canada's obligations under Article 3, paragraph 1, of the Kyoto Protocol;

(d) an equitable distribution of greenhouse gas emission reduction levels among the sectors of the economy that contribute to greenhouse gas emissions;

(e) a report describing the implementation of the Climate Change Plan for the previous calendar year; and

(f) a statement indicating whether each measure proposed in the Climate Change Plan for the previous calendar year has been implemented by the date projected in the Plan and, if not, an explanation of the reason why the measure was not implemented and how that failure has been or will be redressed.

Provinces

(2) A Climate Change Plan shall respect provincial jurisdiction and take into account the relative greenhouse gas emission levels of provinces.

Publication

(3) The Minister shall publish

(a) within 2 days after the expiry of each period referred to in subsection (1), a Climate Change Plan in any manner the Minister considers appropriate, with an indication that persons may submit comments about the Plan to the Minister within 30 days of the Plan's publication; and

(b) within 10 days after the expiry of each period referred to in subsection (1), a notice of the publication of the Plan in the *Canada Gazette*.

Tabling

(4) The Minister shall table each Climate Change Plan in each House of Parliament by the day set out in subsection (1) or on any of the first three days on which that House is sitting after that day.

Committee

(5) A Climate Change Plan that is laid before the House of Commons is deemed to be referred to the standing committee of the House that normally considers matters relating to the environment or to any other committee that that House may designate for the purposes of this section.

REGULATIONS

Regulations

6. (1) The Governor in Council may make regulations

(a) limiting the amount of greenhouse gases that may be released into the environment;

(a.1) within the limits of federal constitutional authority, limiting the amount of greenhouse gases that may be released in each province by applying to each province Article 3, paragraphs 1, 3, 4, 7, 8, and 10 to 12, of the Kyoto Protocol, with any modifications that the circumstances require;

(b) establishing performance standards designed to limit greenhouse gas emissions;

(c) respecting the use or production of any equipment, technology, fuel, vehicle or process in order to limit greenhouse gas emissions;

(d) respecting permits or approvals for the release of any greenhouse gas;

(e) respecting trading in greenhouse gas emission reductions, removals, permits, credits, or other units;

(f) respecting monitoring, inspections, investigations, reporting, enforcement, penalties or other matters to promote compliance with regulations made under this Act;

(g) designating the contravention of a provision or class of provisions of the regulations by a person or class of persons as an offence punishable by indictment or on summary conviction and prescribing, for a person or class of persons, the amount of the fine and imprisonment for the offence; and

(h) respecting any other matter that is necessary to carry out the purposes of this Act.

Measures province considers appropriate

(2) Despite paragraph (1)(a.1), and for greater certainty, each province may take any measure that it considers appropriate to limit greenhouse gas emissions.

Obligation to implement Kyoto Protocol

7. (1) Within 180 days after this Act comes into force, the Governor in Council shall ensure that Canada fully meets its obligations under Article 3, paragraph 1, of the Kyoto Protocol by making, amending or repealing the necessary regulations under this or any other Act.

Obligation to maintain implementation of Kyoto Protocol

(2) At all times after the period referred to in subsection (1), the Governor in Council shall ensure that Canada fully meets its obligations under Article 3, paragraph 1, of the Kyoto Protocol by making, amending or repealing the necessary regulations under this or any other Act.

Other governmental measures

(3) In ensuring that Canada fully meets its obligations under Article 3, paragraph 1, of the Kyoto Protocol, pursuant to subsections (1) and (2), the Governor in Council may take into account any reductions in greenhouse gas emissions that are reasonably expected to result from the implementation of other governmental measures, including spending and federal-provincial agreements.

Consultation for proposed regulations

8. At least 60 days before making a regulation under this Act or, with respect to subsections 7(1) and (2), any other Act, the Governor in Council shall publish the proposed regulation in the Canada Gazette for consultation purposes with statements:

(a) setting out the greenhouse gas emission reductions that are reasonably expected to result from the regulation for every year it will be in force, up to and including 2012; and

(b) indicating that persons may submit comments to the Minister within 30 days after the publication of the regulation.

EXPECTED REDUCTIONS

Minister's statement

9. (1) Within 120 days after this Act comes into force, the Minister shall prepare a statement setting out the greenhouse gas emission reductions that are reasonably expected to result for each year up to and including 2012 from

(a) each regulation made or to be made to ensure that Canada fully meets its obligations under Article 3, paragraph 1, of the Kyoto Protocol, pursuant to subsections 7(1) and (2); and

(b) each measure referred to in subsection 7(3).

Minister

(2) The Minister shall

(a) publish the statement in the Canada Gazette and in any other manner that the Minister considers appropriate within 10 days of the period set out in subsection (1); and

(b) table the statement in each House of Parliament by the day set out in subsection (1) or on any of the first three days on which that House is sitting after that day.

REPORT

National Round Table on the Environment and the Economy

10. (1) Within 60 days after the Minister publishes a Climate Change Plan under subsection 5(3), or within 30 days after the Minister publishes a statement under subsection 9(2), the National Round Table on the Environment and the Economy established by section 3 of the *National Round Table on the Environment and the Economy Act* shall perform the following with respect to the Plan or statement:

(a) undertake research and gather information and analyses on the Plan or statement in the context of sustainable development; and

(b) advise the Minister on issues that are within its purpose, as set out in section 4 of the *National Round Table on the Environment and the Economy Act*, including the following, to the extent that they are within that purpose:

(i) the likelihood that each of the proposed measures or regulations will achieve the emission reductions projected in the Plan or statement,

(ii) the likelihood that the proposed measures or regulations will enable Canada to meet its obligations under Article 3, paragraph 1, of the Kyoto Protocol, and

(iii) any other matters that the Round Table considers relevant.

Minister

(2) The Minister shall

(a) within three days after receiving the advice referred to in paragraph (1)(b):

(i) publish it in any manner that the Minister considers appropriate, and

(ii) submit it to the Speakers of the Senate and the House of Commons and the Speakers shall table it in their respective Houses on any of the first three days on which that House is sitting after the day on which the Speaker receives the advice; and

(b) within 10 days after receiving the advice, publish a notice in the *Canada Gazette* setting out how the advice was published and how a copy of the publication may be obtained.

Commissioner of the Environment and Sustainable Development

10.1 (1) At least once every two years after this Act comes into force, up to and including 2012, the Commissioner of the Environment and Sustainable Development shall prepare a report that includes

(a) an analysis of Canada's progress in implementing the Climate Change Plans;

(b) an analysis of Canada's progress in meeting its obligations under Article 3, paragraph 1, of the Kyoto Protocol; and

(c) any observations and recommendations on any matter that the Commissioner considers relevant.

Publication of report

(2) The Commissioner shall publish the report in any manner the Commissioner considers appropriate within the period referred to in subsection (1).

Report to the House of Commons

(3) The Commissioner shall submit the report to the Speaker of the House of Commons on or before the day it is published, and the Speaker shall table the report in the House on any of the first three days on which that House is sitting after the Speaker receives it.

OFFENCES AND PENALTIES

Offences

11. (1) Every person who contravenes a regulation made under this Act is guilty of an offence punishable by indictment or on summary conviction, as prescribed by the regulations, and liable to a fine or to imprisonment as prescribed by the regulations.

Subsequent offence

(2) If a person is convicted of an offence a subsequent time, the amount of the fine for the subsequent offence may, despite the regulations, be double the amount set out in the regulations.

Continuing offence

(3) A person who commits or continues an offence on more than one day is liable to be convicted for a separate offence for each day on which the offence is committed or continued.

Additional fine

(4) If a person is convicted of an offence and the court is satisfied that monetary benefits accrued to the person as a result of the commission of the offence, the court may order the person to pay an additional fine in an amount equal to the court's estimation of the amount of the monetary benefits, which additional fine may exceed the maximum amount of any fine that may otherwise be imposed under the regulations.

Officers, etc., of corporations

(5) If a corporation commits an offence, any officer, director, agent or mandatory of the corporation who directed, authorized, assented to, or acquiesced or participated in, the commission of the offence is a party to and guilty of the offence and is liable on conviction to the punishment provided for the offence, whether or not the corporation has been prosecuted or convicted.

Offences by employees or agents

(6) In any prosecution for an offence, the accused may be convicted of the offence if it is established that it was committed by an employee, agent or mandatory of the accused, whether or not the employee, agent or mandatory has been prosecuted for the offence.

References

Canada. 2008a. *A Climate Change Plan for the purposes of the Kyoto Protocol Implementation Act* 2008. Ottawa: Environment Canada.

Canada 2008b. *Detailed Emissions and Economic Modelling.* Ottawa: Environment Canada

Canada 2008c. Canada's Offset System for Greenhouse Gases. Ottawa: Environment Canada

Canada 2008d. Regulatory Framework for Industrial Greenhouse Gas Emissions. Ottawa: Environment Canada

Canada 2008e. Canada's Credit for Early Action Program. Ottawa: Environment Canada

Canada. 2007a. *A Climate Change Plan for the purposes of the Kyoto Protocol Implementation Act* 2007. Ottawa: Environment Canada.

———. 2007b. *Regulatory Framework for Air Emissions.* Ottawa: Environment Canada, 2007.

———. 2006c. Canada's Energy Outlook: The Reference Case 2006.

———. undated. Renewable Power Production Incentive: A Discussion Paper (Natural Resources Canada), see http://www2.nrcan.gc.ca/es/erb/CMFiles/RPPI_Discussion_Paper_August_3173MJT-01092005-8155.pdf.

Davis, Lucas W. 2007. Durable goods and residential demand for energy and water: Evidence from a field trial of front-loading clothes washers. University of Michigan working paper, as resubmitted to the *Rand Journal of Economics.*

Dubin, Jeffrey A., and Daniel L. McFadden. 1984. An economic analysis of residential electric durable good holdings and consumption. *Econometrica* 52, (2): 345–362.

Dubin, Jeffrey A., Allen K. Miedema, and Ram V. Chandran. 1986. Price effects of energy-efficient technologies: A study of residential demand for heating and cooling. *RAND Journal of Economics* 17, (3): 310–325.

Farrel, A., R. Plevin, B. Turner, A. Jones, M. O'Hare, and D. Kammen. 2006. Ethanol can contribute to energy and environmental goals. *Science* 311: 506–508.

Hausman, Jerry A. 1979. Individual discount rates and the purchase and utilization of energy-using durables. *Bell Journal of Economics* 10, (1): 33–54.

Hill, Jason, Erik Nelson, David Tilman, Stephen Polasky, and Douglas Tiffany. 2006. Environmental, economic, and energetic costs and benefits of biodiesel and ethanol biofuels. *Proceedings of the National Academy of Science* 103, (30): 11206–11210.

Jaccard, Mark, and Nic Rivers. 2007. *Estimating the effect of the Canadian government's 2006–2007 GHG policies.*

National Roundtable on the Environment and the Economy (NRTEE). 2007a. The National Round Table on the Environment and the Economy, *Interim Report to the Minister of Environment,* June 2007.

———. 2007b. The National Round Table on the Environment and the Economy, *Response of the NRTEE to its Obligations Under the Kyoto Protocol Implementation Act*, September 2007.

———. 2006. The National Round Table on the Environment and the Economy, *Advice on a Long-term Strategy on Energy and Climate Change*, June 2006.